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ABSTRACT

Intended for researchers, policy makers, and planners, the studies in this volume examine issues in communication policy and planning in developing nations. The five studies discuss the following: (1) the organizational and methodological aspects of communication planning, including structure and organization, methods and models; (2) the economics of communication, including the limitations of economic theory and inhibiting influences and innovations; (3) long-range communication policy and planning, including futures research and Delphi technique in policy and planning; (4) lessons for communication planning in urban and regional planning methodology, including the planning process as it applies to communication planning; and (5) lessons for communication planning in educational planning, including educational planning models and indicators of effectiveness. (HTH)

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Planning Methods, Models, and Organization:
A Review Study for Communication
Policy Making and Planning

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PREFACE

The five studies included in this volume were undertaken at the request of the Division of Free Flow of Information and Communication Policies, Unesco, Paris. A grant provided by Unesco to the Communication Policy and Planning Project of the East-West Communication Institute, was utilized in organizing the cooperative study. A report submitted in April 1977, was reviewed and accepted by Unesco.

This volume is a revised and improved version of that original report. The revision was done mainly on parts 2 and 3 of this volume. This publication is aimed at researchers, policy-makers, and planners who are interested in communication policy and planning.

I would like to take this opportunity to thank Mr. Lloyd Sommerlad, Unesco, for his interest and initiative in proposing this study. Ms. Kay Garrett, Publications Officer, East-West Communication Institute, deserves credit for completing the publication arrangements on the eve of her departure from the Institute. On behalf of the study team, I extend her our warmest Aloha!

Honolulu
August 1978

Syed A. Rahim
Project Coordinator

PART 1

The Organizational and Methodological Aspects of Communication Planning

Syed A. Rahim

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CHAPTER 1: THE SCOPE OF THE REPORT

Research and development on policy analysis and planning methods and models is a major concern of contemporary applied social sciences, particularly economics, sociology, and management and administration. It is clearly reflected in the research literature and in the increasing participation of professional social scientists in the actual processes of public policy-making and planning in the developed and developing countries. Today, many economic and other social science models and techniques are available for use in policy-making and planning in the public and the private sectors. Theories of socioeconomic growth and development, planning models derived from those theories, quantitative techniques for the application of planning models, and data bases for policy-making and planning constitute a substantial body of the literature of contemporary social sciences. The literature is particularly rich in four areas--economic growth and development, urban and regional planning, long-range societal futures planning, and educational planning.

SCOPE AND PURPOSE

This report is a broad review of planning methods discussed in the available literature. It is written for a special purpose and for a special audience of communication planners and policy researchers. The main purpose is to examine how the current literature on planning models and methods take into consideration (a) the needs for communication planning and how they are relevant to communication planning, and (b) the roles and functions of planning organizations and structures, particularly in the area of communication planning.

The study of communication policy-making and planning involves analysis and understanding of the technological and institutional characteristics of various components of the system of communications in society. It requires a variety of techniques, models, and analytical frameworks. Only recently communication researchers began to pay attention to this. The new area of communication policy and planning research will benefit from a review of the planning literature in other fields. Planning researchers and practitioners will find such a review useful in their search for methods, models, and techniques of communication planning.

NATIONAL COMMUNICATION SYSTEM

The main orientation of this report is macro planning at the national level. We are defining a national communications system composed of interrelated components and elements. The nature of the system varies from country to country depending largely on the political structure and the overall level of socioeconomic development. The main function of each component of the communication system is one or more of the basic communication activities--creating, gathering, storing, processing, and distributing messages carrying information. The term information is used in a very broad sense so that entertainment programs in radio and television are also considered as messages carrying information of some kind. Some of the specific components of a national communication system are telecommunications, radio, television, book publications, press, etc. The organizations dealing with these matters and technologies used in them are elements of the components of communication systems. However, these communication systems may be defined more broadly to include all industries which produce information machines or provide information services. It may also be possible to include public and private financial and administrative organizations which deal mainly with information. The extent to which such components should be included in the communication system itself is a problem for planners, and it depends on the scope and purpose of planning.

The following list of agencies and organizations is only an example of various components of a national communication system: (1) postal services; (2) telecommunications: telegraph, telephone, telex, and micro-

wave radio communication services; (3) radio and television: governmental, commercial, and educational broadcast; (4) satellite services for telecommunication and broadcast; (5) computer telecommunication link-up and data banks; (6) libraries and documentation centers; (7) press: newspapers and periodicals; (8) books and other publications; (9) records, cassettes, video tapes; (10) films and movies; (11) other audiovisuals; (12) popular culture, including traditional forms of communication such as puppets, open-stage drama, shadow plays, etc.; (13) organized interpersonal communication such as agriculture or health extension services, nonformal education; (14) meteorological communications: weather forecasts, earthquake, tsunami, and typhoon warnings; (15) commercial and trade communication: stock prices, cost of living indices, commodity prices, export-import, exchange rates; (16) advertising; (17) administrative and security communication services; and (18) defense communications network.

We also assume that the communication plans should have a broad perspective about the future communications in society and its relationship with other social processes. In order to develop this perspective, the communication planners should be able to understand the current situation and trends reflected in the structure and activities of communication and other social processes. This means that the communication planner should take a long-term view of the situation in making choices regarding communication technologies and institutions and in evaluating them. This point of view of communication planning is more than just setting objectives, formulating specific schemes and projects, and allocating resources.

COMPONENTS OF THIS REPORT

This report is divided into five parts. Part 1 provides a review of the literature that examines the roles and functions of planning organizations and structures, with special reference to communication planning. The literature on this particular problem is very meager, and not much information is available on how communication planning is carried out in various national settings. Part 1 also includes a summary of the main findings of Parts 2-5.

Part 2 is a review of major economic planning approaches and their implications for communication planning. This was prepared by Don Lamberton. It reviews selected planning models and how they treat communication/information factors. The conceptual and methodological problems in using those models for communication planning are discussed, and a new approach incorporating communication into the planning model is suggested.

Part 3, prepared by Dan J. Wedemeyer, examines methodological approaches involving general systems theory and future research techniques in planning communication needs, rights, and resources. It specifically examines Delphi and cross impact analysis techniques as methodologies for communication policy and planning.

Part 4 is on urban and regional planning methodologies. John C. Holmstrom looks into this area for lessons for communication planning. This part reviews a number of specific techniques and methods of planning used in urban and regional planning.

Part 5, on educational planning methodologies, was prepared by John Middleton and Barclay Hudson. It examines the planning models and methods used in education and lessons for communication planning.

CHAPTER 2: PLANNING ORGANIZATION AND STRUCTURE

The most common context of public policy making and planning is the efforts of government at policy formulation and planning for national development. In almost every country of the world, government policies are made regularly on fiscal matters, labor, education, health, and trade, and some planning is done at the national level. Many countries, including some developed countries, prepare national plans for three- or-five year terms. Annual planning within the framework of these plans is a common practice. Continuous monitoring and evaluation of the plans is also done in many countries. Because of the extensiveness and regularity of planning functions and tasks, permanent agencies within the government administrative structure are assigned planning responsibilities. Professional planners work closely with policy makers and decision makers at various levels.

NATIONAL DEVELOPMENT PLANNING

Analytical and descriptive information on planning organizations are available in the literature on development planning. Probably the best single source is Waterston's Development Planning: Lessons of Experience (1974). About half of this 729-page book is devoted to the organization of development planning. The following review of development planning organizations is largely based on Waterston.

The structure and role of planning organizations are mainly determined by the form of political institution and the level of technocratic/bureaucratic development in the public sector. In socialist countries, a powerful central planning agency is an essential first step. In the mixed economies, centralized planning organization develops gradually as planning proceeds at lower levels. In some countries, the resource allocation and coordination functions of the central planning agency are carried out by the Ministry of Finance. Planning and programming units at the sectoral levels are essential for effective operation of a central planning agency. However, planning units at that level are not adequately developed in most countries.

In many countries, the government sets up task-oriented commissions, committees, and study groups composed of members from the public and private organizations within the country and consultants from outside the country. Such groups are often asked to formulate objectives, strategies, and draft programs. These temporary groups work in collaboration with planning agencies and other government departments, but operate in a more flexible manner.

THE CENTRAL PLANNING AGENCY

The scope and authority of a central planning agency varies from country to country. Where it is wide the main functions include (1) formulation and revision of long-term, medium-term, and annual plans, specification, and reconciliation of programs in the sectors and subsectors of the plan; (2) preparation of annual operational plans required to implement the five-year or three-year plan, and adjustment from previous year's experiences; (3) seeking, negotiating, and coordinating development aids and assistance from outside; (4) analysis of and formulation of policy statements on various aspects of the plan; and (5) periodic evaluation of the plan and its programs.

The central planning agency does not prepare or allocate budgets, but in many countries the budgeting process is closely linked to the planning process. Actual release of funds is made after endorsement of programs and projects by the planning agency. The effectiveness of centralized planning depends on the coordination between budgeting and planning processes. Competition between the central planning and budgeting agencies for jurisdiction and authority sometimes leads to serious bottlenecks in the implementation of plans.

The effectiveness of a central planning agency depends on a number of factors: (1) relations with plan-implementing agencies and organizations; (2) a stable and close relationship between the planners and the chief decision makers in the government; (3) communication with special interest, private groups, and the legislature; (4) support of professional groups, especially economists, engineers, and managers; and (5) mobilization of resources, particularly for developing countries' external resources in the form of loans, grants, and technical assistance.

OTHER PLANNING AND PROGRAMMING UNITS

The planning and programming units in the operating ministries and departments are crucial in a country's planning system. Such units maintain two-way communication between the operating units within the ministry and the central planning agency. They also help and coordinate project formulation and implementation activities of the operating units by laying out methods and procedures. When these units work closely with their respective sectoral units in the central planning agency, many of the constraints and problems of coordination are avoided.

Unfortunately, in many countries not much attention is paid to building and strengthening these units. The ministry or department either avoids planning or depends on the central planning agency. Consequently, project formulation and programming is weakened and the planning becomes more paper work than a guide for action.

Building a good programming unit does not require a large amount of manpower or investment. In fact, it is more effective when kept small but carefully organized. It can delegate many activities to the operating units and concentrate on general analysis, research, data gathering and analysis, coordination, and evaluation. The responsibility of organizing such a unit should be taken by the operational ministry or department. It is unrealistic to expect that the central planning organization would organize and operate it.

Setting up regional and local planning offices is another important aspect of a national planning organization and structure. The need for a decentralized planning organization is seldom disputed. Its importance for agriculture and rural development is most strongly felt in the developing countries. The community development program in India and the rural communes in China provide some models of decentralized planning and implementing institutions. In these and other models, the planning and other functions at different levels of the institutional set-up are not clearly separated. The planning literature has very little information on the process, quality, problems, and needs of planning at these levels. But it is generally agreed that improvement of planning at those levels is essential for the success of centralized planning.

Local level planning is also important for political and economic reasons. It ensures better participation by the people, greater local resource mobilization and utilization, and better adjustment to local needs, in planning and implementing projects and schemes. Local planning often encourages innovation and diffusion of ways of doing things in a self-reliant manner. This reduces, at least temporarily, the burden of procurement and allocation of resources by the central planning and administrative agencies.

THE SECTORS IN CENTRAL PLANNING ORGANIZATION

It is a common practice to divide the operations of the central planning agency into a number of sectors. This is partly dictated by the administrative structure of the government and partly by the form of the economic theory and models used in planning. The most common classification consists of the sectors of Industry, Agriculture, Transportation and Communication, Education and Health. The organizational characteristics of the central planning agency are influenced by the way the sectors are defined and by the priorities assigned in staffing and providing other facilities. For instance, the communication and transportation sector is usually concerned with the technical and physical infrastructure of roads, bridges, telephone networks, and radio communication networks. Accordingly, these sectors perform more economic and engineering functions and are staffed by economists and engineers. We shall later discuss the implication of this for comprehensive communication planning.

LOCATION AND TYPES OF CENTRAL PLANNING AGENCIES

Setting the main goals and objectives of national development and selecting the main strategies for their implementation involve political action. On the other hand, the preparation of plans and projects involves such technical actions as statistical and economic analysis and examination of social and environmental implications of particular projects, etc. Therefore, planning functions consist of relating activities ranging from political decisions to specific technical exercises. The planning process operates best when there is a direct and close relationship between the actions at the political level and the actions at the technical level. In most countries, the relationship between the political and technical levels is achieved by a cabinet level committee headed by the chief executive of the government. This cabinet committee makes all the important political decisions and the planning agency works under its direct instruction. The planning agency is usually headed by a professional, in most cases an economist. The planning agency works best when its chief has the full confidence of the nation's chief executive and his ministers. The chief of the planning agency needs to work very closely with the

political decision makers. His ability to translate technical knowledge and information into political terms determines, to a large extent, the influence of the planning organization on the cabinet committee.

The location of the central planning agency varies from country to country. Where there is a deep commitment to development planning, the central planning agency is located in the chief executive's office. In some countries, there is a ministry of planning; in others, the planning agency is located in the ministry of finance or interior. Probably the most common location is the ministry of finance. In some countries, the central planning agency is an autonomous body outside the normal government administration. Experience shows that there is no best location for a central planning agency. It varies from country to country depending on other factors. However, when the location is such that the central planning agency is closest to the top decision making bodies of the nation, it works best.

LONG-RANGE POLICY AND PLANNING ORGANIZATION

In highly industrialized countries, long-range planning is given particular attention. The emphasis is often on policy making rather than planning for particular programs or projects. In the capitalist countries, planning functions are diffused over many government and private organizations. The need for an integrated central planning body within the government is discussed occasionally. A recent report on long-range planning prepared by the United States Congressional Research Services (1976) examines the planning institutions in the United States and makes several observations on some fundamental issues.

The report points out that locating long-range planning functions in the office of the chief executive is crucial when one considers the need to relate the planning and serious action. But this has a disadvantage. Historical experience in the United States suggests that this may make planning succumb to short-term political pressures.

Locating the planning agency as an independent body in the executive office of the President has some advantages. Then the planning agency will have high standards and visibility and potential for higher activity. The danger is that such an independent high-level body may isolate itself from other key legislative and executive agencies and become an ivory tower for planning.

If the planning agency is placed in the Office of Management and Budget, there would be better linkage between planning and budgeting and other action-oriented operations in the government. Here the danger is that the planning agency may lose visibility and succumb to the bureaucracy. These issues and problems are similar to the organizational problems of development planning in less-developed countries.

CORPORATE PLANNING ORGANIZATION

The organizational arrangement in corporate planning has been reviewed in the U. S. Congress research services study on long-range planning. In large, decentralized private corporations, the planning function is also decentralized. The planning function is basically a staff function. The main planning decisions are line functions. But the chief executives are assisted by planning staff. According to this study, the planning functions at the corporate level are "to assist top management by identifying critical policy questions, by providing early warnings of changes in the business environment, by helping to identify corporate goals and objectives, and coordinate, stimulate, encourage, and service planning in the operating divisions." At the operating level, the planning functions are decentralized to the managers of individual divisions. The planning function is a part of the top management functions. A common institutional device for planning is the top management committee headed by the chief executive. This committee formulates corporate goals and objectives, sets priorities for resource allocation, and devises broad policies and strategies. Many firms have a small planning unit which assists the top management in its planning function. Each corporate planning unit is staffed by professional people. Usually, these units are small in size. The normal practice is to keep the units small and responsible to the chief decision maker. Since planning and action are closely associated in corporate business, the planning function is decentralized over the operating units. In fact, the operating units have a large responsibility for program planning leading to specific actions. At this level, planning is a technical function often indistinguishable from the other management functions.

CHAPTER 3: COMMUNICATION PLANNING STRUCTURE AND ORGANIZATION

The planning literature examined in preparing this report provides very little information on the nature and extent of communication planning and the organizations involved in communication policy formulation and planning. The literature of communication policy and planning does not contain much information on the structure and organization of communication planning (Rahim 1976).

It is not difficult to understand why there is a marked gap in the literature. Traditionally, the planning literature is concerned mainly with economic planning, and the communication literature is unconcerned with policy and planning problems as they refer to the structure and organization of planning. The economic planners do not take communication or information as an endogenous variable in their planning models. The communication scholars suspect policy and planning of being controlling and restricting devices to be avoided in academic pursuits. Therefore, the planning activities are restricted to the technical aspects of the telecommunications infrastructures. The conventional economic planning models are used for infrastructure planning, by treating communication machines and equipment as any other economic goods. The communication scholars treat telecommunications as a technical area having very few appropriate problems for investigation by human communication researchers.

COMMUNICATION PLANNING ORGANIZATION IN LESS-DEVELOPED COUNTRIES

A limited but significant amount of communication planning is carried out in many developing countries. The scope of planning is usually limited to short-range policy formulation and project preparation for building the communication infrastructure. Comprehensive communication planning as defined in Unesco reports, or long-term planning as recently carried out in Canada and Australia, are not common practices in the less-developed countries. Because communication planning is short-range and subsumed under the overall development planning, there is no elaborate structure of organizations for communication planning. But there are communication planning activities carried out in different agencies and at different organizational levels. The following general description based on information obtained from the national development plans of twenty developing countries will give some idea of communication planning structure and organization in developing countries. As an illustration, some detailed information is given on one country which recently constituted a planning commission and prepared its first five-year plan.

Typically, the hard core of communication planning is in the transportation and communication sector of the national development plan. The most common communication industries and services included in this sector are the postal and telegraph services, telecommunication industries, telephone and radio communication services, telex services, and sometimes, the satellite communication network. In some countries, the radio and television services are also included, particularly when major investments are made in building or expanding these broadcasting facilities. Excluded from this are the print media (press and book publication), extension services for agriculture, health, etc., library and documentation centers, films, audio-visual material production, government publicity and information centers, instructional communication, and various security and warning communication systems.

The organizational arrangement for planning at this level is relatively simple. There is usually a section or division in the central planning agency which is responsible for the sectoral planning in the communication and transportation sector. The section is staffed by economists and professional communication engineers. The section works closely with the operational departments responsible for building and maintaining postal and telecommunication infrastructures. When the mass media facilities such as radio and television are included in the sector, the planning section also works with the radio and television organizations in the country. It should be

pointed out that planning at this level is seldom done on the basis of an elaborate communication policy framework. In most cases, communication planning is subsumed under the overall development planning, and the communication objectives and targets are defined mainly in terms of the development objectives and targets.

The ministry of information is another important location in the overall government structure for communication policy and regulations. The operating departments under this ministry are responsible for framing regulations and guidelines for the printed and electronic media of communication. Depending on how much control this ministry has on the specific communication institutions, the planning at the project level is guided by the administrators in the ministry. Sometimes the ministry works independently of the central planning agency because it does not view the regulatory or guiding activities as planning functions. The ministry of information is also responsible for planning and management of a large publicity and information mechanism of the government.

Project level communication planning is carried out in a number of other sectors, notably in agriculture, education, health, and population/family planning. At this level, communication planning is carried out as a support to the substantive project planning. The project plan includes communication elements. No separate plans for communication within the project are prepared. Nor are the various communication elements in different projects in the sector pooled together and integrated into a common framework.

The planning function is carried out by the operational organization responsible for the project. There is no separate planning cell or unit for communication. The chief executive officer of the agency and his top aides are the planners. Usually, they do not have much professional knowledge of communication or of planning methods and models.

AN ILLUSTRATION: COMMUNICATION PLANNING ORGANIZATION IN BANGLADESH

The following brief presentation is an illustration of communication planning structure and organization in a new developing country, which made a serious effort at comprehensive development planning, supported by international development assistance organizations. In Bangladesh, the Planning Commission located in the Ministry of Planning was constituted in 1972 by a presidential order. The commission was asked to prepare an immediate rehabilitation plan and a five-year development plan for the new and war-ravaged country. The organization of the commission was designed by well-known development economists fully conversant with the experiences of planning structure and organization in other countries. The commission was constituted as a powerful central body directly linked to the Cabinet and the President. The President was the chairman of the commission. The Deputy Chairman of the Planning Commission was a professional economist holding the rank of a Deputy Minister. He was the chief executive officer and reported to the President.

The planning commission is divided into a number of divisions and sections. The sectoral planning programs are distributed among those divisions and sections. In 1972 there were four Commission Members, each responsible for one or more divisions. All of them were professional economists. One of the Members was in charge of the Industry Division, Physical Planning and Housing Division, and the Communication and Transport Division. The Communication Section of the Communication and Transport Division was headed by a telecommunication engineer. He was the Director General of the Telecommunication Department deputed to the planning commission to help in formulating the first five-year plan. His assistant was also a telecommunication engineer.

The communication sector-planning covers five sub-sectors, each belonging to a government department or public corporation. These are: (1) Telegraph and Telephone Department, (2) Post Office, (3) Television, (4) Radio, and (5) Meteorological Department (Bangladesh Planning Commission 1973).

The communication section of the planning commission works in collaboration with the departments. The basic information and initial project proposals are received from the departments. The feasibility and cost effectiveness of the departmental proposals are examined and the different proposals are coordinated by the communication section. The focus of planning is on the allocation of resources for capital investments and institutional arrangements for the implementation of the projects. The emphasis is on building the technical and institutional infrastructure. But policy matters regarding the use of communication resources are also examined and recommendations made to the government.

The planning for the utilization of communication resources for development is made at the level of project planning in various departments, particularly in Agriculture, Health and Education, and Information. The departmental projects include some communication components. But the projects are reviewed and processed in the respective sections of the planning commission. The communication section of the planning commission does not coordinate the communication components of those departmental plans and projects.

At the departmental level there is, in fact, very little systematic communication planning. The departments do not have communication experts to help them in planning. They do not even have adequate planning staff for their substantive projects. The same kind of situation prevails in the communication agencies--radio, television, telecommunication, post offices, etc. These agencies do not have adequately trained planning staff. The scope of planning is usually limited to only new projects requiring substantial capital investment. Planning for better and efficient management of resources and improved services is either absent or done in a very crude fashion. Similarly, planning is geared to the immediate needs and current problems. There is little concern about long-range future of communication in the society.

COMMUNICATION POLICY AND PLANNING ORGANIZATION IN INDUSTRIALIZED COUNTRIES

In the highly industrialized countries, the public sector plays a relatively minor role in communication planning. The government is mainly concerned with broad policies, regulations, and their implementation. Communication planning is carried out in the private sector, in the corporations and firms engaged in communication industries and services. It is a part of the overall corporate planning and does not seem to have any special characteristics by which it can be distinguished from other kinds of planning. Organizationally there is no distinct set-up or units that could be called the communication planning unit.

Recently, however, there have been some notable efforts by governments at long-range communication policy formulation and planning in a number of industrialized countries. The experiences in two countries, Canada and Australia, are worth mentioning.

PLANNING IN AUSTRALIA

The Australian government recently made a major effort at policy analysis and planning for long-term development of telecommunication in Australia (Telecom Australia 1975). The scope of this study and analysis is broad. It not only examines the long-term futures of telecommunications in the context of social, economic, and technical futures, but also discusses the approach of "open planning" and the future role of Telecommunications Authority. The policy and planning study was carried out by the National Telecommunication Planning (NTP) Branch, Australian Telecommunication Commission, Australian Post Office (APO). The planning team used inputs from a variety of methods in preparing its planning report Telecom 2000. These were: (1) commissioned external studies, (2) seminars, (3) internal studies and discussion papers, (4) consultative meetings, and (5) overseas visits.

One of the problems studied by the planning team was communication planning method or approach. The team's conclusion was that telecommunication planning processes should ensure continuous community participation in decision making at appropriate stages, and therefore the approach should be broad, flexible, and open planning.

In a flexible and open planning approach, decision areas are first identified and located at different levels. For instance, the placing of public telephone booths or radio towers--which are community level issues; or the introduction of new national services, allocation of radio frequency spectrum, setting of long distance telephone rates--which are national level issues. Different forms of planning organizations are needed to handle the different types of planning at different levels ranging from the community to the national level. The relationship between the planning agency and the community should be such that information flows back and forth between them, and planning decisions are taken after a due consideration of the community's reaction to alternatives presented to it by the planning agency. At the higher level, open planning can be facilitated if the planning decisions are made by an independent decision making body which is connected to the community and the government, and information flows between these three components of the planning structure. In some countries, commissions or tribunals are established to perform the role of the independent decision making body. Experience shows that precaution is needed to safeguard the independence of such bodies. Sometimes such bodies become highly bureaucratic, and they function more like a government department than as an independent body. They become too much concerned with rules and regulations and their implementation rather than with the needs and requirements of the community which they are supposed to serve. As regards the future role of the Telecommunications Authority, the Australian Planning Study recommends: (1) multidisciplinary study of future telecommunications, and studies on the social effects of telecommunication in Australia, (2) monitoring of economic, social, and technical environments, and the Telecommunication Commission's involvement in a wider area of communication policy for education, information, etc., (3) organization and establishment of a closer relationship with telecommunications users' groups and insuring such groups participation in policy formulation and planning decisions, and (4) promoting decentralization by delegating decision making to the regional and local administrative units of communication organizations.

PLANNING IN CANADA

In Canada, the Ministry of Communication is responsible for dealing with the policy and planning issues

at the level of federal government. The provincial government and the private organizations operating communication agencies also play crucial roles in formulating policies and plans. Recently, the Ministry of Communications has taken the initiative in organizing communication policy and planning studies. In some of these studies the structure and role of policy and planning organizations have been examined and some recommendations made. In a recent position paper prepared by the Ministry of Communication, several issues relating to ownership, control, management, and coordination of federal and provincial objectives have been reviewed and analyzed (Pelletier 1973).

The broad objectives of a national communication policy in Canada are to develop and safeguard the Canadian national unity and identity, and at the same time, to maintain the diversity of values and cultures of different communities. In this, the federal institutions have to play a historically unifying role in a more broad and responsible fashion. An orderly and effective development of modern communication services for all Canadians is a basic communication objective. To meet the objectives, the Ministry of Communication proposes to do a number of things: (1) develop a mechanism for constitution and policy coordination between the federal, provincial, and private agencies, (2) formulate ways of using technological advances, (for example, co-axial cable, satellite) for the benefit of all Canadians, (3) devise and consolidate legislation relating to telecommunications and broadcasting, and (4) establish a single federal agency for the regulation of telecommunication carriers and broadcasting operations subject to federal authority. This last proposal has a special significance for communication structure and organizations in Canada. Bringing the telecommunication carriers, radio, television, cable television, computers, and satellites under a single, federally regulated agency will facilitate closer interaction and coordination within the federal system, and collaboration and consultation between the federal, provincial, and private agencies. Such an arrangement is also desirable from the technical point of view because the differences between the various kinds of communication services tend to disappear as the whole system becomes physically and operationally compatible and interconnected due to technological advances in telecommunications.

PLANNING IN THE UNITED STATES

The communication policy making and regulatory activities in the United States are quite substantial, although not so visible from outside. In a recent article, Polishuk described the process of telecommunication policy making and institutions of the United States government (1976).

Organized policy making in the United States federal government structure is diffused over the legislative, executive, and judicial branches. In the legislative branch, there are two subcommittees on communications—one in the House of Representatives and the other in the Senate. The offices of Technology Assessment and the General Accounting Services also carry out policy research and assessment activities. These organizations have wide jurisdiction covering common carriers, broadcasting, satellite, and cable television.

In the executive branch, the Office of Telecommunication Policy (OTP) is responsible for policy formulation, planning, and coordination of communication activities under the jurisdiction of the federal government. The activities of OTP include policy and planning, government communications, international communications, records management, common carrier, national security and privacy, and policy planning research. The specific problem areas and issues include economy of scale, rate structures, mobile communications, cable television, national warning system, procurement policy for government communications, news services development, international communication satellites, international trade in telecommunications, and various aspects of the spectrum management.

In the Department of Commerce, there is another office of telecommunication which is engaged in technical analysis and policy formulation. This office provides necessary services to the Institute of Telecommunication Sciences at Boulder, Colorado. The policy issues examined by this Office of Telecommunication include domestic satellite policy, national warning system, spectrum conservation, cable television policy, common carrier regulations, and biological effects of telecommunications. The Department of Transportation has an office of telecommunications, which deals with telecommunication support for various kinds of transportation systems. Similarly, the Departments of State and Defense have agencies dealing with telecommunication policy and planning. The Department of Defense has elaborate arrangements dealing with various defense and security communication systems.

Among the independent federal agencies dealing with communication, the most important is the Federal Communications Commission (FCC). The Federal Communications Commission is essentially a regulatory body. The scope of regulation includes radio, television, telephone, telegraph, cable television, mobile radio, and satellite communication. The work of the Federal Communications Commission is divided into a number of offices and bureaus: the Office of General Counsel, the Office of Chief Engineer, the Office of Executive Director, the Field Operations Bureau, the Broadcast Bureau, Cable Television Bureau, Common Carrier Bureau, Safety and Special Service Bureau. There is also a new office of Plans and Policy. This office carries

out long-term policy planning research in mobile radio, frequency allocation, computer communications interface, electronic mail, technological developments in local exchange and local distribution, electronic funds transfer, rural television, common carrier regulatory economics, and international communications.

The National Science Foundation is another independent federal agency that carries out telecommunications policy research. The NSF objectives are to support research on telecommunication policy issues, the application of telecommunications for public services, and the social impacts of communication technology. It provides funds and grants for research to various universities and other research institutions all over the country. The major areas of research supported by NSF grants during the last three years are: telecommunications planning, telemedicine, citizen feedback, public service cable television, regulatory issue analysis, development of teleconferencing systems, and social impact of broadcasting

CONCLUSION

The present body of literature on planning structure and organizations is very limited in scope and coverage. It is difficult to find relevant information on communication planning organizations in the planning literature. Obviously, more surveys and case studies are needed to obtain the essential information. A six-country study on communication policy and planning currently conducted by the author at the East-West Communication Institute, Honolulu, Hawaii, will provide more information on this next year.

The review presented in this report suggests that the scope of communication planning today is limited to telecommunications and newly installed mass communication systems. The focus of policy study and planning is on the hardware and the infrastructure. The broad notion of communication held by communication scholars and the comprehensive definition of a national communication system (as suggested by Unesco) are not held or used by the actual planners in various government organizations. The communication planners are mostly telecommunication engineers and economists. Their perception of communication planning is shaped by economic and engineering concepts and models. Professional communication scholars and specialists have not shown much interest in communication policy and planning. Only recently have communication researchers begun to pay some attention to this area. These factors have affected the form and function of planning structures and organizations in communication.

The information available on communication planning structure and organizations seems to indicate that a significant amount of relevant activities actually goes on in various government departments and agencies. But researchers have not paid much attention to those activities. Communication policy formulation and planning take place at various points and levels of the government organization in developed and developing countries. In the absence of centralized coordination and public dissemination of information, those activities remain less visible than policy-planning activities in other public issues like energy or environment.

CHAPTER 4: PLANNING METHODS AND MODELS

The literature on planning methods and models is large and varied. Only some parts of this literature are relevant to our specific purpose here. Our main interest is to explore the literature for ideas and methods suitable for the tasks of communication policy formulation and planning. We have organized our study into five parts. This is the first part. We have already examined the structures and organizations for communication planning. In this chapter we shall briefly review recently developed large-scale modeling for worldwide planning. We shall also summarize the main findings in the other four parts of our study. As mentioned in the introduction, the areas covered by these four parts of the study are: economic development planning, long-range planning of the futures of society, urban and regional planning, and educational planning.

There are many planning and forecasting models and techniques available for different kinds of planning tasks--problem identification, formulation of alternatives, assessment of impact, and evaluation. The planning models are conceptual and analytical tools. They are not physical constructs like the model of an aircraft. They are symbolic and verbal constructs for a logical analysis and scientific processing of raw empirical data. The purposes of planning models are to obtain information and knowledge for policy decisions. Planning models frequently involve complex mathematical formulation and massive quantitative and numerical analysis. The availability of high-speed computers has greatly facilitated use of planning models in policy formulation and development planning.

SYSTEM DYNAMICS MODEL

The complex interdependent nature of policy issues and planning problems in real life presents serious challenges before planning researchers to develop dynamic models based on the systems approach. In a systems approach of planning, the problem area is carefully examined in order to identify its boundary, environment, and the components or subsystems. Particular attention is given in identifying the relationship between the system and its environment, and the relationship between components within the system. In systems analysis, the goals and objectives are first conceptualized, and then alternative means for attaining the objectives are developed. At the same time, the alternatives are evaluated in terms of their costs and benefits. Models are then built to simulate and predict the consequences of alternative policies and strategies. The results are used (in combination with other information, insight, and wisdom) to indicate the course of action.

The system dynamics model is a structural model. The total nature of the problem area, as well as interaction between each part, is demonstrated in the model. In addition, the model provides feedback loops relating a variable at two different points in time. The dynamic nature of the model provides scope for changes over time in the attributes of the system; thus allowing a great deal of flexibility. This kind of model is powerful in testing the consequences of alternative policy and planning decisions. It is also possible to use this kind of model for testing the importance of a particular parameter or the consequences that the model projects for the system. The system dynamics model has been developed for the study of world problems--population, environment, resources, etc. The research of a group at M.I.T. led by Forrester, and the work of the Club of Rome are well known. We shall briefly examine one recent model, the Mesarovic-Pestel Model, to see its relevance for communication policy and planning in a world context.

MESAROVIC-PESTEL MODEL

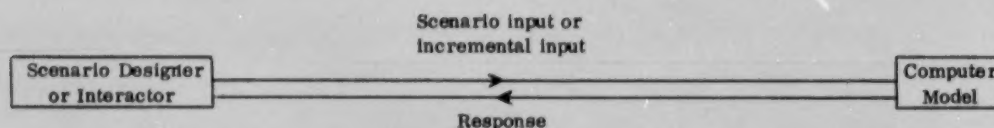
The core of the Mesarovic-Pestel Model is an economic model based on an input-output framework (1976). The world system covered by the model is composed of a number of regional systems, each of which is represented by specific submodels. The core economic model is linked to a number of submodels on population, energy, food, etc. According to Mesarovic, "a hierarchical structure has been adopted for the model in which

each level in the hierarchy represents the evolution of the world system, within a context defined by a given set of laws and principles. Specifically the levels involved are geophysics, ecological, technological (man-made, energy, and mass transfers), economic, institutional, socio-political, value cultural, and human biological. Such an approach enables the optimum use of confirmed scientific knowledge and available data."

The world system represented in the model consists of a number of regional subsystems in order to take account of the variety of socio-political and economic regions in the world. The scenario and interactive mode of analysis used in the model is described by Mesarovic as follows:

SCENARIO AND INTERACTIVE MODE ANALYSIS

(Source: Mesarovic and Pestel 1976)



"In the scenario analysis, the sequence of possible events, termed the scenario, is selected which determines the inputs that are applied in the computer model in order to assess the likely consequences if such events indeed take place. In the indirect, or conversational mode, the input to be computed is applied incrementally over time. The interactor, the planner, the decision maker, or the policy analyst evaluates the effect of previous incremental inputs before selecting a new increment. The analysis is the outcome of a man-machine symbiosis based on a suitable division of labor between them. Man decides on priorities, costs, and risks to be taken when the computer specifies the breadth of options and indicates the likely consequences of decisions (Mesarovic and Pestel 1976).

Note the two components of the model and their interactions. The "scenario" component is the human component. Through it, the ideas and objectives of policy makers, planners, and scholars are presented for interaction with a mathematical system of equations solved by the high-speed computer. The computer-part of the model operates on the basis of previously stored data and sets of equations specified by the designers of the model. These data and equations embody knowledge obtained through theoretical analysis and empirical research in specific problem areas of economics, population, food, energy, etc. The computer is used for data storage and complex numerical analysis generated by the process of scenario presentation to the model. Without the computer the model would be impractical because of the enormous time and labor needed for data storage, retrieval, and numerical analysis.

In its present form, the Mesarovic-Pestel model consists of a number of sub-models dealing with food and nutrition, population, agricultural and non-agricultural production, energy, and international trade. The basic techniques are econometric. There is no communication sub-model. Communication factors are sub-assumed in the models of the substantive areas, as is normally done in economic planning models (see Part 2 of this report for a discussion on communication factors in economic planning).

Theoretically, it is possible to add a communication sub-model to the Mesarovic-Pestel system of planning modeling. It will involve some intensive research for the development of quantitative measures of communication in society and examination of their relationships to other socio-economic indices. It will also be necessary to carry out theoretical and conceptual exercises to construct mathematical and logical systems describing the processes of communication in society and their interaction with other social, economic, and political systems within and outside the society.

However, within the present structure of the model it should be possible to use communication concepts and constraints in formulating and adjusting scenarios, and in this way indirectly judge the impact of alternative communication policies and strategies on economic growth and development. The basic principles of Mesarovic-Pestel model can be used in developing a long-term planning mechanism for communication where policy inputs and the computer will interact. Another advantage of the model is that it can account for qualitative inputs which in interaction with the quantitative processes in conventional planning (programmed in the computer) provide far better results than the deterministic models of economic planning.

ECONOMIC DEVELOPMENT PLANNING METHODS

Economic development models are the most common types of models used in planning. These models

are designed to study the consequences of policies affecting the allocation of resources, particularly the division of investment among sectors. The models are derived from economic growth theory, particularly the neo-classical theory, and they more or less incorporate strategies and constraints generated by political objectives and government policies. The practical utilization of these models requires quantitative data indicating the states and conditions of socio-economic life in society.

In economic development planning models, communication is treated in a variety of ways. Melody has described some of these as follows: (1) investment alternatives in communication facilities, (2) communication (like transportation) as an economic infrastructure, (3) new communication technology as exogenous factor stimulating economic growth and development, and (4) communication as a network relating various factors in the economy (1977).

These conceptions of communication in the contemporary economic development framework have a marked influence on communication planning. First, the planners examine the scope of investment in building and expanding telecommunications and mass communications facilities and infrastructure. Planning communication becomes similar to planning of an industry or physical services. Second, communication as a support to the substantive area (agriculture, population control, education, etc.), is handled as a secondary planning function at the project level. In either case, the planning of communication, if any, is carried out within the conventional sectoral and project levels. And in the same manner as the industrial or services sector planning is carried out.

The economist's concept of communication and its role in development is the focus of Lamberton's review in Part 2 of this study. Lamberton presents a brief but provocative review of recent developments in a new area of economic research dealing with information and communication.

At the conceptual level, economists have recently done some research in two directions: (1) the labor-intensive nature of communication and the increasing trends of employment in communication in the post-industrial society, (2) the structural aspects of communication services and its role in economic development. The process of communication has been conceptualized as a sequence of linked activities consisting of inquiry and information gathering, transmission of constructed messages, and utilization of received messages in decision making. Men and machines play their roles in different degrees of efficiency and effectiveness in performing activities in those sequences. The machines do a better job at transmission of messages. Men are better in the inquiry activities.

The quantity and direction of flow of information have bearings on the functioning of an economic system. As an economic system grows, its information system becomes more complex. Information multiplication seems to improve the functioning of economic systems. Therefore, information/communication is a very important factor in economic analysis.

However, Lamberton's broad conclusion is that communication/information has not been adequately treated in economic theory and development planning. A substantial modification of the conceptual structures and theories of economic development are needed to provide the basis for development of an effective approach of communication planning in an economic framework.

At least for the present there is a hopeful sign. The new area of information economics is slowly growing and showing some promises. The main focus of research in this area seems to be on the structural aspect of communication as a symbol-manipulating service. The extent and quantity of communication services in the highly industrialized countries are growing very rapidly, bringing fundamental structural change in the economy. In this context, a promising approach for planning is to take a demand and supply notion and adopt an input-output structure for analysis. This requires that communication/information be defined and identified as a sector in the economy. Then the powerful method of input-output analysis can be applied for communication planning and policy formulation.

A number of economists have recently taken this communication sector approach. The latest position of research in this area is reflected in Marc Porat's work (1976). He defines the information system in the United States economy in terms of a primary information sector and a secondary information sector. The primary information sector includes all industries manufacturing communication goods and providing communication services, distributing those goods and services, financial and educational institutions whose primary function is information-based, and all political and professional organizations including labor unions. The secondary information sector consists of the public and private bureaucracies. These information sectors are related to the other three main sectors of the economy: the private productive sector, the public productive sector, and the households. Porat's model shows how goods and services, information, and labor flow between these sectors of the economy. The flow of information in the model is a non-market transaction. It consists of command and control, planning and coordination, advertising and market information, and political information.

Porat illustrates how an accounting system can be developed on the basis of the structure provided in his model, and how it can provide opportunities for various kinds of analysis. He demonstrates the use of input-output analysis and shows how it can be used to make basic policy decisions. The model no doubt provides a promising framework for communication planning in developed societies and developing countries.

GENERAL SYSTEMS THEORY, FUTURES RESEARCH, AND POLICY PLANNING METHODS

The quantitative and sectoral methods of economic planning impose severe restrictions on the planners who are interested in a holistic, long-term approach of planning. Where the planner is concerned with alternative futures of society his context is very broad and long-range, and he is interested in alternative patterns of technology, institutions, and values. He needs planning methods which can deal with qualitative and normative aspects of life as a comprehensive process in a long time span.

There is a considerable body of literature on long-range and comprehensive approach towards societal policy making and planning. In Part 3, Dan Wedemeyer has reviewed some of this literature and indicated an approach for communication planning. His study has brought together ideas and methods from (1) General Systems Theory, (2) Policy and Planning Science, (3) Futures Research Methodologies, and (4) Studies on Communication Needs, Resources, and Rights. The focus of his study is on synthesizing concepts from these different areas and indicating the possibilities for communication planning.

Wedemeyer takes the position that communication planning should take place in a broader context of the societies' communication resources, needs, and rights. The consideration of individual and community needs is basic for any meaningful planning. It also has important implications for planning approaches and methods. If planning is based on the needs of people and their institutions, the methods and approaches have to be open and participative. Similarly the communication rights of individuals and groups should be a basic factor determining the substance and method of planning. The consideration of needs, rights, and resources also implies that comprehensiveness--in terms of covering various aspects of life over a long period of time--should be the goal of planning in communication.

This broad view of communication planning demands a comprehensive methodology. The General Systems Theory provides a basis for developing a comprehensive approach to communication policy making and long-term planning. The general systems approach provides scope for a realistic handling of communication problems as they are related to other socio-political problems. In such a framework it is possible to use qualitative and normative variables for policy analysis and planning.

After presenting a framework based on the notions of communication needs, rights, and resources, and the theory of general systems, Wedemeyer examines some specific methods and techniques used in futures planning. He discusses in some detail the methods of Delphi and Cross Impact Analysis and examines their relevance for communication policy planning. The Delphi method of policy analysis and planning consists of techniques for collecting and processing normative and judgmental data from a specific set of individuals, and in the process, allows communication and feedback among the members of the set. A common end result of a Delphi process is a series of policy-oriented forecasts about the future. The forecasts are group opinions obtained through questionnaires.

The cross-impact analysis is a computer-based technique for examining the interactions between various forecasts obtained through Delphi. It can be used to adjust and improve individual forecasts in obtaining higher internal consistency among a set of forecasts about future events. In comprehensive communication policy planning, this technique has a potential use in assessing the impact of one line of development in communications over other lines of development.

URBAN AND REGIONAL PLANNING METHODS

The field of urban and regional planning developed, particularly in the United States, as a response to the planning needs for land use, transportation and similar physical problems at the State and City government levels. Recently, the scope of this field has broadened considerably, covering such diverse problems as community welfare and fiscal policy. The literature on this field is quite large. John C. Holmstrom has examined this literature in Part 4, with a belief that "the potential of transferring methods from urban and regional planning to communication planning is significant and that this examination of methods can lead to a more efficient development of the communication planning field in terms of a saving of time and efforts."

Holmstrom examines the general paradigm used in urban and regional planning. This is based on a systems-

view of planning. The planning process consists of a number of interconnected components or stages: (1) problem identification, (2) understanding the system, (3) generating alternatives, (4) assessing alternatives, (5) choice of a preferred alternative, and (6) Ex Post evaluation. The planning activities take place at the project, program, and policy levels. The nature and problems of planning differ at these stages and levels.

Different techniques and methods have been developed to deal with the planning problems at different stages and levels. For instance, at the problem identification stage inputs from experts can be obtained by using Delphi techniques. Other methods including opinion polls and group interviewing can be used to obtain inputs from the people at the grass roots. At the system identification stage various modelling techniques (statistical and mathematical) can be used profitably. In assessing alternatives, methods developed for environmental impact analysis, cost-benefit analysis, etc. can be used in communication planning. If quantitative measures of communication are available, linear programming and other optimizing techniques can be used to find optimum solutions of specific problems.

Holmstrom refers to a number of similarities of problems between urban planning and communication planning. For instance, the flow of people, goods, and services can be compared to the flow of information. The planning methods developed for transportation planning can be relevant and useful for communication planning. Such methods as the network analysis, queueing and modal split modelling, gaming techniques, Forrester's dynamics modelling, environmental impact analysis, social impact analysis, cost-benefit analysis, etc., are relevant for communication planning. The most useful way of utilizing those methods will be to understand their logic and rationale and to adapt them to the specific needs of communication planning.

EDUCATIONAL PLANNING METHODS

The final part of our study is on educational planning. This part has been prepared by John Middleton and Barclay Hudson. It explores the area of educational planning in search of methods and lessons for communication planning.

Educational planning is particularly relevant for communication planning. As a discipline it has grown rapidly because conventional methods of economic planning were found to be inadequate to handle complex problems of human education in society. It is more concerned with the non-material human factors essential for the growth and development of all societies. There are important conceptual links between the disciplines of education and communication. Educational systems produce and consume communication resources. The communication systems facilitate broadening of the scope of education. The education and communication sectors of a society are linked in different ways at different levels.

Middleton and Hudson present a review of the current state of educational planning. They examine the problems and issues, the planning process, the planning approaches and models, and the indicators of educational effectiveness. The most common concerns of educational planning are: (1) social demand, (2) manpower forecasts (3) cost-effectiveness, (4) integrated planning (5) local level planning (6) equity, (7) education and unemployment, (8) life-long education, (9) education and the broad development objectives and ideologies, and (10) non-formal education. The communication planner can easily see that some of these issues are also the basic issues in communication planning. The first six issues can be listed as important issues for communication policy and planning in any society.

Educational planning is concerned with a number of social processes: growth, social mobilization, quasi-market factors, political factors, and structural reforms. The main strategies adopted in educational planning are cybernetics, knowledge networks, and creative learning.

Different kinds of models are used in educational planning for different kinds of tasks such as target setting, resource allocation, cost-benefit analysis, social impact analysis, etc. The review presented by Middleton and Hudson covers development in five areas: (1) manpower planning, (2) educational production function, (3) cost-effectiveness analysis, (4) heuristic modelling, and (5) systematic models of instructional development.

The indicators of educational planning are of three general kinds: (1) school-based indicators, usually measuring the internal efficiency of educational institutions; (2) economic output indicators, measuring the effects of education on human capital formation; and (3) social process indicators, referring to specific processes of social life. This includes measures of equity, participation, etc.

The experiences of educational planning provide lessons that seem to be highly relevant and potentially rewarding for communication planning. The educational planners are confronted with the problems of equal

opportunity and the right to equal outcome, the importance of efficiency/effectiveness and the need to uphold values and norms. These questions are probably more important for communication planners because communication rights, norms and values are stronger and more universal. Educational planners have been able to develop appropriate indicators and quantitative methods to deal with certain planning problems. They are now exploring the more complex problems of planning in an open system encompassing broader social issues and ideas. Communication planners have yet to develop the normal quantitative techniques common in planning sciences. The pervasive nature of communication in society has led them to adopt a broad approach to planning from the beginning. But quantitative techniques are necessary. Here, the experience and knowledge accumulated in educational planning can be of particular value to communication planners.

Among the basic tasks confronting communication planners are defining the boundary of a national communication system, identifying the components of the system, understanding the relationships between the components, and developing indicators to measure the inputs, outputs, and flows in the system. Again, the experiences of educational planning can provide useful guidelines to communicational researchers engaged in these tasks.

Certain techniques and models used in educational planning can be used in different contexts including communication. The cost-effectiveness models can be useful in planning media campaigns for development programs or commercial purposes. Cost-benefit analysis and other optimization methods can be used in assessing and selecting alternative communication infrastructures and management organizations in countries adopting new communication systems. In certain areas such as non-formal education, the communication and educational planners can work closely and collaboratively.

Finally, in their efforts to build more powerful heuristic models for comprehensive and long-term planning, the innovative work in education and communication can be coordinated to converge toward development of models for common use.

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PART 2

The Economics of Communication

26

Donald McL. Lamberon

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CHAPTER 1: INTRODUCTION

This monograph evolved from an earlier report which had as its terms of reference:

1. A brief review of major development planning approaches and models and their economic theory foundations.
2. A critical review of how those approaches and models treat communication/information factors.
3. Evaluative comments on how those models can be used for national/institutional communication planning, and what are some of the conceptual methodological problems involved in such utilization.

The initial emphasis upon communication planning for developing countries has been modified in the direction of more general interest in the role of communication in economic growth irrespective of the income level of the countries concerned.

The literature search has been confined very largely to economists' literature for several reasons. First, the limitation of the author's competence. Secondly, time and research assistance resource constraints. The broad conclusion that emerges is that the treatment of communication/information processes has been most inadequate and does not provide a basis for planning unless a radical revision of the theory of economic development can be carried out. Probing for the reasons for this state of affairs paves the way for progress. The fundamental nature of the inhibiting factors tends to explain why the growing but piecemeal research attack on information problems is unlikely to have more than limited success. Significant progress can be achieved once the analytical need for a communication/information sector of the economy is recognized and the resources necessary for the establishment of an adequate data base provided. Without this integrating framework there will continue to be a partial and therefore inadequate understanding of the role of information processing in society.

Even this achievement will be beset by residual doubt concerning the nature of commodities and of information. As Stiglitz points out, "The production and dissemination of information is different in a number of fundamental ways from the production of ordinary commodities. One simply cannot transfer the tools and modes of thinking that have been developed for the latter into the analysis of the production of information. (This is not to say, however that there is no carryover.)" (1971, p. 1). Stiglitz argues that the quantity of information cannot be measured—he does not consider the Shannon "information theory" measure appropriate. His efforts have been directed to an analysis that dispenses with a measure of the quantity of information. Perhaps this calls for some explanatory comment. The "information theory" development flowed from the design of communication systems to work in biology and the social sciences. In the process many writers were caught up in the atmosphere of innovation and failed to appreciate that "information" in the information theory context was not synonymous with "meaning." As Dunn points out, the communication engineer's measure tells nothing about the content, value, truthfulness, exclusiveness, history or purpose of the information, all of these being relevant to the way in which social systems process information (Dunn 1974, p. 27; fn. 1, p. 46).

A further feature of the situation is the link between information and the concept of a commodity. "Indeed, even what we mean by a "commodity" is dependent upon our "information structure" (Stiglitz 1971, p. 2). This implies not only that there is a need to modify conventional economic analysis of commodities

but also that the information sector approach, in that it seeks to separate information activities from other activities, is subject to a serious limitation. Nevertheless, it is a major step forward from the present state of affairs in which economics very largely attempts to persevere with models that ignore the human dilemma of incomplete knowledge.

Because of the extremely wide range of material of both theoretical and empirical character, this monograph has been written on the basis of a limited number of significant illustrative contributions. These contributions complement each other and could well be viewed as a rather large, even multi-volume collection of readings. Despite these reservations the thesis that emerges is that the role of communication must be viewed broadly as an integrated part of human information processing. The structuralist approach to development policy can be utilized provided there is a sufficient awareness of the process nature of economic activity.

CHAPTER 2: SOME MATTERS OF DEFINITION

Some matters of definition must be explored at this early stage. Consider the two sets of introductory comments presented below.

A simple way of regarding human communication is to consider it as the sending from one person to another of meaningful messages. Such a minimal definition implies all the essential elements that we will have later to consider. Thus it presupposes a communicator and a receiver, and a relationship between them— a mutual awareness, or orientation of one to another. It implies an intention, especially on the part of the communicator; an external referent—what the message is about; a common language and some sharing of experience. Finally, it indicates some activity and change of state as a result of the act (McQuail 1975, pp. 1-2).

Communication is part of the very fabric of society. It takes place at all levels between peoples and between institutions, from government to people, from people back to government, and through many channels both inter-personal and mediated.

The ways in which communication is used, the networks through which it flows, the structures of the media system, the regulatory framework for the system, and the decisions of the people who operate it, are all the outcome of communication policies. Policies are the principles, rules and guidelines on which the system is built and may be specifically formulated or remain largely implicit.

In any society, the communication system must fit organically into the political and socio-economic system of the State, and be consistent with its cultural values. While there are many common features in all communication systems, objectives, functions and policies will differ depending both on the degree of development of the country and its political philosophy (Sommerlad 1975, p. 7).

Even brief reflection raises contrasts and problems. Person expands to peoples, institutions, and governments. The sending of meaningful messages becomes communication or information flows. The intimate relationship between two people is lost in a communication system. These and other transformations pose difficult unsettled questions. How important is the speed and continuity of the information flow? What is the distribution of human information processing capacities? What determines changes in that distribution? Are there property rights, legal or otherwise established, in information? How important is so-called 'misinformation' and information redundancy?

These are complex questions. They are unsettled questions. Nevertheless, some steps can be taken to simplify the problems. One such step can be attributed to Marschak (1968). Marschak examined "the successive links in the sequence of symbol-manipulating services: inquiry, or data gathering; communication of messages; and deciding upon actions on the basis of messages received" (1968, p. 39). The user's demand for these services is a joint one and overall performance can be improved by effective control or improved methods at each separate stage. It is important to consider the man vs. machine aspects of these stages or activities. Marschak concluded that humans are very poor transmission channels. The encoding and decoding parts of communication permit marked human superiority, e.g. programming contributes one half to the value added by computing organizations (Marschak 1968, p. 55). The inquiry phase favours human capacity.

There are two broad implications of this line of thought. The first relates to the labour intensity of communication activities and will be taken up in Chapter 8. The second concerns the structural aspect of these

symbol-manipulating services. Adopting input-output technique and demand-supply notions, Marschak's simple schema provides the basis of an approach to defining an information sector. This is so central to the proposed approach to communication planning that selected contributions in the development of the information sector approach will now be reviewed.

EGON NEUBERGER

Neuberger (1966) sketched a conceptual framework by posing the following questions: "(1) who makes what decision — the problem of organization; (2) what information does he receive, what signals does he send out, and how does he ascertain the degree of correspondence between his signals and the actions taken by others — the problem of information; and (3) assuming given objective functions for each actor in the system, what are the incentives that will motivate him to reach a given decision, based on the information at his disposal — the problem of motivation" (p. 132). He pointed out that:

Information (the collection, transmission, processing, storage and retrieval, and analysis of economic data, the communication of orders or other signals, and the feed-back necessary for the evaluation of decisions taken as a result of the signals) is a necessary input into every aspect of economic decision making. The larger the number of participants in the economic process, the greater the division of labor, the more complex the technological processes, and the wider the assortment of goods and services an economic system produces, the more information intensive the economic process becomes (pp. 132-3).

To evaluate the informational efficiency of the system he assumed two subsystems: an information and a production subsystem. Three types of effects on total output were considered:

The Input Effect

By absorbing resources the information subsystem reduces the output potential of the production subsystem.

The Qualitative Output Effect

The provision by the information subsystem of better information about relative scarcities of goods, without absorbing more resources, enables the production subsystem to move closer to an optimal position.

The Quantitative Output Effect

The provision of better information by the information subsystem on the shape of production functions and resource availability, without using more resources, enables the production subsystem to increase output. Neuberger noted (p. 133) that "in the long run, it can affect the supply of resources themselves and the level of technological knowledge."

JÁNOS KORNAI

Kornai (1971) examined the flows between organizations and units in the economic system. He divided these into two main categories: product flows and information flows. He pointed out that:

As far as the description and analysis of product flows is concerned, our discipline is reasonably far advanced. The Leontief models, the input-output tables (or, rather, the tables of real inputs and outputs) and the programming models describing the real processes have provided us with an easily manageable tool for investigating the problem. Less satisfactory are the results in the description and analysis of information flows. Economics has an enormous debt which remains to be paid (p. 58).

The information flows were further subdivided into three major categories; money, price type, and non-price type information flows. Several propositions about the information structure were put forward.

For every actually existing economic system the information structure is complex. Historically, the complexity of the information structure increases with the expansion and development of the real processes. There is an even greater amount of information connected with the same event which flows sequentially, over the course of time or simultaneously; in other words, the information flow is expanding (p. 62).

Table 1 classifies the characteristics of information flow structures.

The complexity of decision problems, uncertainty, the comparative unreliability of information and the increasing risk involved in important decisions made under uncertain conditions lead to multi-channel information and the multiplication of information gathering. Concerning the same real event multiple information partly of price-character, partly of non-price character will be received through several channels, in various phases, at several times, in various degrees of fineness (p. 66).

This is intended to show that information multiplication can improve the functioning of the economic systems. Kornai suggests that "The factors listed ... go a long way towards explaining why the demand for complex information flows is increasing" (p. 66).

F. L. PRYOR

Pryor (1973) is of particular interest because he carries out his analysis from both structural and process viewpoints (pp. 336-7). He distinguishes "three major structural elements: (1) the structure of property; (2) the structure of motivation (i.e. what are the goals of important property right holders or decision-makers and what are the incentives to which they respond); (3) the structure of information (i.e. what information is available to the various property right holders and what types of information networks link these decision-makers to one another)" (p. 337). The existence of other factors determining the performance of the system is acknowledged: environmental factors such as natural resources, international trade situation, the level of technology and policy factors. Interactions take place between structural elements and given the process content, inconsistencies can emerge. These inconsistencies can be of several types (Pryor 1973, pp. 344-7);

Motivation-Information Inconsistencies

Incentives based on arbitrarily determined prices need not lead to desired production levels or production processes.

Property-Information Inconsistencies

Information may not be available at the appropriate time or place or the recipient may lack the capacity to process the information.

Information Inconsistencies

Conflicting signals may be given where there are parallel power structures or other forms of fragmentation of the system.

TABLE 1. CHARACTERISTICS OF INFORMATION FLOW STRUCTURES

Criterion	Simple information structure	Complex information structure	Factors tending to increase in complexity of information structure
Price vs non-price character	Information of price character only	Information of price + non-price character	
Direct vs Indirect	Direct reflections and simple transmission Indirect reflections	Direct reflections + Indirect reflections with one or more transmissions	Increasing number of transmissions
Addresser	Anonymous information Single-channel information flow	Specified addressers Multichannel information flow	Increasing number of channels
Time-lag	Single-phase reflection	Multi-phase reflection Anterior and posterior time horizon	Increasing number of elements in reflection series Increasing anterior and posterior time horizon
Fineness	Single degree of fineness	Several degrees of fineness simultaneously for the same event	Increasing amount of information with varying degrees of fineness for the same event

Source: Kornai, 1971, p. 63.

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Porat (1977) illustrates the further development of these attempts to define an information system. His work relates to the U.S. economy which he describes as 'information based'. The production, processing and distribution of information goods and services accounted for 25 percent of GNP in 1967. Included in this "primary information sector" are goods such as computers, communication equipment and books; and services such as telecommunications, the media, education, R & D and selected business services. In addition, information services produced by non-information firms (and governments) for own-consumption accounted for 21 percent of GNP. Included in this "secondary information sector" are all nonmarket information services, such as management, secretarial support, accounting, etc. The secondary sector is the information overhead necessary to organize firms and coordinate markets. By 1970, the wage bill paid to all "information workers" exceeded that of the agricultural, industrial and service occupations combined. His study had two goals: first, to define and measure the two information sectors and to formally introduce them into the National Income and Product Accounts, and, secondly, to build the sectors into a Leontieff input-output model and to examine their internal structure and their interactions with other industries in the economy.

Porat divides the economy into six sectors:

(1) THE PRIMARY INFORMATION SECTOR

This includes all industries producing information machines or selling information services on markets, e.g. computer manufacturing, telecommunications, printing, mass media, advertising, education. More systematically, this sector includes eight major classes of industries: the knowledge production and inventive industries; information distribution and communication industries; risk management industries including components of finance and insurance; search and coordination industries, including all market information and advertising vendors; information processing and transmission services, both electronic and nonelectronic; information goods industries, including information machines; selected government activities that have direct market analogs in the primary information sector - including the postal services and education; support facilities such as office and education buildings. The secondary information sector consists of the greater part of the public bureaucracy and the whole of the private bureaucracy, i.e. the costs of organizing firms, maintaining markets, developing and communicating prices, regulating markets, etc.

(2) THE PUBLIC BUREAUCRACY

All informational functions of government are placed here, e.g. planning, coordinating, deciding, regulating.

(3) THE PRIVATE BUREAUCRACY is made up from the informational activities of non-information firms.

(4) THE PUBLIC PRODUCTIVE SECTOR is solely engaged in the production of non-informational public and quasi-public goods, e.g. highways, dams, transportation, defense.

(5) THE PRIVATE PRODUCTIVE SECTOR includes all market activities in non-informational goods and services.

(6) THE HOUSEHOLD SECTOR provides the labor resources and is the final consumer of the 'output' of the primary information sector and the private production sector.

The results of Porat's study will be reported in Chapter 7. At this stage his conceptual approach has been indicated. It paves the way for a modification of the traditional structural approach. The magnitude of the total information 'sector' surely justifies some attention to its share in other countries. Furthermore, the magnitude in combination with the spectacular changes popularly referred to as the information revolution would seem to warrant study of the structural relationships within the information sector. The significance of the information sector for external relationships invites empirical inquiry.

Against this background of illustrative developments, this monograph turns to a review, first, of the limitations of economic theory and, secondly, of the current state of the theory of economic development. In neither case do the selected contributors have much to say about communication/information processes and their contribution to economic development. As will be seen an economic theory deeply rooted in static systems of thought, heavily dependent upon equilibrium analysis, and having an assumption of perfect knowledge as its identification badge is ill-suited to the task. However, care has been taken to avoid a 'straw man' accusation. The contributors are widely regarded as major scholars in these fields. Despite the somewhat negative outcome, this review is believed helpful in two respects. First, it clarifies the reasons for comparative neglect of these

processes; and secondly, by review of the existing modes of thinking it becomes possible to comment on the practicability of modification to incorporate an information sector approach.

CHAPTER 3: THE LIMITATIONS OF ECONOMIC THEORY

Revolutions are often slow processes. This is illustrated by the response of economic thought to what is being called the information revolution. More than a half century ago Knight wrote of "the most thoroughgoing methods of dealing with uncertainty; i.e., by securing better knowledge of and control over the future" (1921, p. 260). Control of the future and increased power of prediction are, he added, "closely interrelated, since the chief practical significance of knowledge is control, and both are closely identified with the general progress of civilization, the improvement of technology and the increase of knowledge" (p. 239). "Information" was "one of the principal commodities" supplied by the economic organization (p. 261). The information industry included market associations, trade journals, statistical bureaus, advertising, and a "veritable swarming of experts and consultants in nearly every department of industrial life" (p. 262). But unfortunately Knight dismissed these methods of dealing with uncertainty because they represented "merely the objective of all rational conduct" (p. 260).

Not only did Knight himself dismiss these methods of dealing with uncertainty on the grounds that they represented "merely the objective of all rational conduct" (p. 260) but Hicks in his well-known review of Knight's book (1931) challenged the importance of the "true uncertainties" assigned a major role by Knight and to a large extent responsible for the existence of the information industry:

Some metaphysical foundations--some assumptions about the application of probability to economics--are indeed unavoidable. But these should surely be kept as simple as possible... (It) will be assumed that in any economic operation whose result cannot be certainly foreseen, there are objective chances of various results. Where a large number of identical operations are undertaken, this is unquestionably true. The chance of a particular result in any particular operation will be the ratio of the number of cases in which that result occurs to the total. And most operations, which do not form part of a class of this sort, are nevertheless separable into partial operations which do; or if not, they form part of a class of nearly similar operations, in which we cannot speak of chances with the same perfect accuracy, but still our error is not large. Those 'unmeasurable risks' or 'true uncertainties' which escape any such classification, and which bulk so large in Professor Knight's theory, must justify their claim to a large measure of our attention by showing that a satisfactory theory of profit cannot be constructed without paying special attention to them. I believe it can (p. 171).*

Hicks' subsequent defense of perfect competition as the working assumption of economists is equally well-known. Consider, for example the following statement:

It has to be recognized that a general abandonment of the assumption of perfect competition, a universal adoption of the assumption of monopoly, must have very destructive consequences for economic theory. Under monopoly the stability conditions become indeterminate; and the basis on which economic laws can be constructed is therefore shorn away. Not only is falling average cost consistent with monopoly; falling

* As I pointed out (1971, fn. 2, pp. 14-15) that Hicks may have modified his view is suggested by the following remark: "It is so easy for the economist to forget that the 'actors' in his models (if the models are to be practically useful) should have at least one characteristic of real people, that they do not know what is going to happen; so that they must take their decisions in the light of possibilities that look as if they might be realized, but which (as we know now from hindsight) are not going to be realized" (1969, pp. 5-6, n. 2).

marginal cost is consistent with monopoly too. There must indeed be something to stop the indefinite expansion of the firm; but it can just as well be stopped by the limitation of the market as by rising marginal costs... It is, I believe, only possible to save anything from this wreck - and it must be remembered that the threatened wreckage is that of the greater part of economic theory - if we can assume that the markets confronting most of the firms with which we shall be dealing do not differ very greatly from perfectly competitive markets.... At least, this getaway seems worth trying (1939, pp. 83-85).

Economists were then caught up with the development of imperfect/monopolistic competition theory and the Keynesian theories of employment. While they continued to sell their wares in the market, there is not much evidence that they were then able to appreciate the significance of the comments that Shackle was later to make:

In the 1930s the Great Theory was destroyed and not replaced. To the zealous theoreticians who performed it, this work of destruction was unexpected, disturbing, often undesired and regrettable. Sir John Hicks openly declared against imperfect competition, Keynes ignored it. Those who had seen the need to modernize the neo-classical edifice were often bemused by the visible difficulties and dangerous consequences of what they were doing, but they had to wait till the very end of the decade to hear the plain report by Hicks and Triffin: they had levelled the old building to the ground. The Great Theory, the General Equilibrium, rests on two indispensable assumptions: of perfect competition and perfect rationality. Rationality is only perfect when relevant knowledge is perfect, and relevant knowledge includes knowledge of the consequences of actions. But the consequences of actions do not yet exist at the moment when choice amongst those actions is being made, and it follows that direct knowledge of the objective, publicly assessable consequences of still-choosable actions is logically impossible. Perfect rationality belongs only to the timeless equilibrium in which all actions conform to a general simultaneous solution of the pooled statements of the tastes and resources of all participants. When economic theory elects to bring in imperfect competition and to recognize uncertainty, there is an end of the meaning of general equilibrium. Economics thereafter is the description, piece by piece, of a collection of fragments. These fragments may fit together into a brilliant, arrestingly suggestive mosaic, but they do not compose a pattern of unique, inevitable order. One vital aspect of the process of theoretical innovation is its destructive aspect (1967, pp. 294-295).

The emergence of the economics of information to be discussed in chapter 6 might be viewed as part of the modernization of 'the neo-classical edifice'. It is being fostered by the growing importance of information activities and the often spectacular events in the development of new information technologies. Three decades after Arthur Clarke of science fiction fame published (1945) his highly innovative suggestions for extra-terrestrial relays, the American Applications Technology Satellite (ATS-6) was stationed some 23,000 miles above Kenya and its broadcast footprint covered most of the subcontinent of India. The experiment to see what contribution communication by satellite could make to India's economic problems was about to begin (Melzer 1974; Mody 1976; Salisbury 1976). Cost reductions in computer technologies have possibly far outdistanced those experienced during the Industrial Revolution (see Phister 1976; *The (London) Economist* 1977; Lange and Remp 1977).

Despite these spectacular events the fundamental problem remains. The fragments that economics tries to piece together are like the fragments the decision-maker has to rely upon in the real process of participation in economic events. It is not surprising, therefore, that the Knight-Hicks clash surfaces from time to time. An excellent recent illustration is Klein's *Dynamic Economics*. Not only does Klein revive the old issues but he attempts to cope with the problems they create. In his own words:

The classical theory of competition cannot explain how progress comes about, because it is premised on the assumption of a completely static world in which firms act on the basis of perfect knowledge. Indeed, if firms acted as if their knowledge were complete, no progress could ever occur! Therefore, to explain how progress does come about it is essential to turn to dynamic economic theory: a theory premised on the assumption of a world of imperfect knowledge. The dynamic theory to be developed in this book is composed of three major elements. First, it is based upon a dynamic concept of stability: the ability to make smooth progress in improving the performance of a technology (for example, automobile technology). The dynamic behavior associated with this stability is described as dynamic efficiency: the efficiency associated with producing a given output with fewer inputs (for example, reducing the cost of automobiles). Second, it is based on a dynamic concept of competition in which firms engage in rivalry to generate better or cheaper alternatives in order to increase their share of the market. In terms of static theory, the firm is regarded as an accounting department that confines its activities to making choices among well-defined alternatives. But according to dynamic theory, the firm is composed of people who are more than technically alive and who, when prodded by a competitor, often regard all of the existing alternatives as unsatisfactory. The third major element is the concept of an open system, without which it is impossible to explain how entrepreneurs generate new knowledge.

His thesis is that such dynamic economic theory is needed to understand the contribution of technological progress to economic growth and changing patterns of trade. For the moment what is most interesting is that the conceptual discussion can move so readily from the fundamentals of decision theory to explanation of real world growth and trade and illumination of the policy problems they generate. This has been facilitated by incorporation of a treatment of information aspects. He provides also a highly significant suggestion that randomness of communications is important in the process of technological change (pp. 164-166).

The aim of this discussion has been to give a rather impressionistic account of the limitations of conventional economic theory in relation to information processes. These limitations are underlined by the report that more than half the total wage-bill of the U.S. economy is paid to workers in information occupations (Porat 1977, p. 107).

CHAPTER 4: A REVIEW OF THE CURRENT STATE OF THE THEORY OF ECONOMIC DEVELOPMENT

This chapter reviews selected recent contributions to the theory of economic development.

K. J. ARROW

Arrow (1975) reflected the disenchantment with intervention. Although believing there is "good theoretical warrant" for government action when large structural changes are sought, he was critical of "the extreme distortions of prices that have ... been used by most developing countries" (p. 2). To this he added "unexpected negative side effects" that arose, for example, because public sectors, like private sectors, proved less than "theoretically perfect" (p. 2). He asserted in his opening remarks that the neo-classical paradigm was deficient in its handling of "the problem of information communication within the economic system - conveying of economically-meaningful knowledge" (p. 1).

What then are the deficiencies of the price system? Arrow notes the following:

INCOMPLETE INFORMATION

The economic agent has to know what transactions are possible, where and at what prices goods can be bought and sold. This information is not always easy to come by, and its acquisition is an aspect of cost, although it is not treated as such, and our economic literature is very poor on how to handle it. Information on price and availability of goods may be publicly supplied; as you know, a certain amount of our economic information, for example, comes through the media. We buy newspapers, but we do not pay for the particular items we want. Rather, the newspaper prints a lot of information, very little of which may be of interest to any particular individual, but it is more economical to combine it. There are many other possibilities, some public, some more private kinds of information. Even in the absence of a market system, a system of planning needs analogous information for efficiency. You can have the same problem under any system, but the resulting form may be different. In particular, one of the reasons why intermediate institutions, like banks, are so important in the field of financing capital, is that there are more grounds for specialization in the acquisition of information in investment than there would be in contemporaneous transactions (p. 13).

DUALISM

The system is viewed as comprising two systems "between which communication and mobility are very imperfect" (p. 14). Arrow's evaluation runs in terms of too much reliance on the argument against *laissez-faire*. It is perhaps useful here to recall Stiglitz's highly significant remark that the very meaning of commodity is dependent upon the information structure.

INCREASING RETURNS

Arrow treats (pp. 14-15) learning by doing under this heading. However, while the process may be a simple one in many cases, the technological progress involves information activities. If the effects are to be sustained information storage, transfer and retrieval become necessary. Learning by doing should perhaps be seen as a step towards an information economy.

INTERNATIONAL DIFFERENCES IN THE COST OF INFORMATION

Even information that is "basic and not owned by anybody" is not transmitted (p. 17). Intellectual capital

is "not cheap" (p. 18). "Information exchange is costly not so much because it is hard to transmit but because it is difficult to receive. A teacher realizes all too painfully the difficulty of getting information into a student's head. Perhaps we should not be totally surprised that the acquisition of information is not the same as its transmission. Giving a man a book is not the same as his comprehending what is in it, particularly if he has to know in a concrete, operational sense. I do not know any really good theories about this process" (p. 18).

In so far as the system is a mixed system there are informational disadvantages of bureaucracy, e.g. to allocate 'scarce' foreign currencies. "This process sets up a decision-maker apparatus that is intrinsically less well informed than the industries or firms themselves. That is an old and very important lesson of classical economics. The firms know what they need. The bureaucrats simply do not spend their whole time at it; even if we assume the highest degree of collective motivation, they cannot be as well informed as industry members" (p. 23).

On these lines Arrow argues that "It is essential for good performance that decision-making be made close to the source of information. If you cannot bring the information to the decision-maker, it may be a good idea to bring the decisions to the source of information" (p. 23).

These comments on communication/information aspects were presented against the background belief in the importance of the efficiency strategy as opposed to technological change and in particular, appropriate technology. "There is considerable gain from efficiency. It is not going to solve completely the problems of underemployment, but to a large extent the drive for efficiency will increase the utilization of manpower, with gains in both output and equity. Achieving greater efficiency requires creation of new institutions such as financial institutions and the protection of contracts. The government thus has a strong protective role to play (p. 22).

THE STRUCTURALIST APPROACH

"The structuralist approach attempts to identify specific rigidities, lags, and other characteristics of the structure of developing economies that affect economic adjustments and the choice of development policy" (Chenery 1975, p. 310).

Yotopoulos and Nugent summarize a major study of data from more than 100 countries that sought to identify structural changes taking place in the process of economic development, i.e. changes in accumulation, mobilization, and allocation as the countries made the transition from income levels of \$50 per capita to levels of \$2,000 per capita. Results are given in Table 2. The normal values were estimated by regressing each structural indicator, x_i , on income γ ; and population, N , in

$$x_i = \alpha + \beta_1 \log \gamma + \beta_2 (\log \gamma)^2 + \gamma \log N.$$

The patterns of sectoral change distinguished in this study relate to primary, industry, and service employment. The normal values in Table 2 show a pronounced decline in agriculture balanced by the rise of both industry and service activities. Such findings have fostered a search for the determinants of sectoral change and inquiry into the effects of sectoral change on growth. Such inquiries have generated theories of balance and unbalanced growth and have prompted disaggregation to achieve fuller understanding of the processes of change. Contrasts were drawn between backward and forward linkage industries. The detailed results of these studies, as reported for example by Yotopoulos and Nugent (Chapter 16, *The Morphology of Growth*) are not of interest in this context. Rather attention should be directed to the industrial classification and the level of aggregation.

TABLE 2. QUANTITATIVE INDICATORS OF
STRUCTURAL CHANGE IN THE PROCESS OF ECONOMIC DEVELOPMENT

Structural Indicator	Normal Value of Structural Indicator at Per Capita Level of:						Proportion of Change Completed by Per Capita GDP of:		Timing Class-ification
	\$50 (1)	\$100 (2)	\$200 (3)	\$400 (4)	\$800 (5)	\$2,000 (6)	\$200 (7)	\$400 (8)	
1. Gross national saving as percent of GNP	7.8	11.0	14.1	17.1	19.9	23.4	40	78	Early
2. Gross domestic investment as percent of GDP	12.7	14.8	17.1	19.4	21.8	25.2	35	73	Early
3. Capital inflow as percent of GDP	4.9	3.8	3.0	2.4	2.0	1.8	61	93	Early
4. Government revenue as percent of GDP	12.2	14.2	17.0	20.6	25.1	32.4	24	42	Late
5. Primary and secondary enrolment ratio	17.5	36.2	52.6	66.9	78.9	91.4	48	67	Early
6. Adult literacy ratio	15.3	36.5	55.2	71.5	85.4	100.0	47	66	Early
7. Food consumption as percent of total consumption	61.9	56.1	49.9	43.0	35.9	25.6	33	52	Neither*
8. Gross product of primary sector as percent of GDP	58.1	46.4	36.0	26.7	18.6	9.8	46	65	Early
9. Gross product of industry sector as percent of GDP	7.3	13.5	19.6	25.5	31.4	38.9	39	58	Early
10. Gross product of service sector as percent of GDP	29.9	34.6	37.9	39.9	40.5	39.3	85	100	Early
11. Exports as percent of GDP	16.5	17.1	18.2	19.7	21.6	24.8	21	39	Late
12. Industry exports as percent of GDP	0.0	0.8	3.7	6.9	10.5	15.7	24	44	Late
13. Birth rate	46.6	41.8	36.6	31.1	25.3	17.1	34	53	Neither*
14. Death rate	20.5	15.2	11.4	9.3	8.9	10.9	93	114	Early
15. Urban population as percent of total population	6.9	20.0	33.8	45.5	55.3	65.1	49	68	Early
16. Primary employment as percent of total employment	84.2	74.0	57.4	43.9	29.0	7.1	35	52	Neither*
17. Industry employment as percent of total employment	6.5	9.9	15.3	23.4	31.1	40.5	26	50	Neither*
18. Service employment as percent of total employment	19.5	21.8	27.3	32.7	40.0	52.4	24	40	Late

*'Neither' indicates neither 'early' nor 'late.'

Source: Chenery, H. B., H. Elkington, and C. Sims (1970), "A Uniform Analysis of Development Patterns," Economy Development Report No. 148 (July), Project for Quantitative Research in Economic Development. Cambridge: Harvard Center for International Affairs, Table G, pp. 42-43 as quoted in Yotopoulos and Nugent 1976, p. 288.

Examination of the classifications in studies reported by Yotopoulos and Nugent suggest little interest in the role of communication. Printing and publishing, transport, and services are the only categories distinguished in a series of major studies that relate to the information sector. In similar fashion Panchamukhi (1975) reports detailed linkage coefficients for India, Indonesia, Malaysia, and the Philippines. Categories related to the information sector are as follows:

India: office domestic equipment, radio, telephone and telegraph equipment, printing, other services.

Indonesia: printing, transportation, communication, insurance, banking and financial institutions, public administration and defense services.

Malaysia: printing and publishing, transportation and communication, banking and insurance etc., other service industries.

Philippines: printing and publishing and allied industries, banking and financial institutions, life and non-life insurance, transportation, communications, government services.

These studies suffer from the severe limitations of available statistics that have been collected on the basis of traditional classifications. None appear to be informed by or even such to capture the role of communication in a comprehensive sense in the process of development. Nevertheless, the approach through sectoral analysis and linkages could be employed to study the information sector, its internal dynamics and the evolution of its relationships with other sectors.

ADELMAN, MORRIS AND ROBINSON

This paper summarizes the authors' findings with respect to anti-poverty policy in developing countries "gained in the course of three different major research projects focused upon the relationship between the various facets of modernization and relative and absolute poverty. The first is a cross-section statistical study of the sources of differences among countries in the relative income shares of the poorest 60 percent of households. The second is a historical analysis of processes and initial conditions leading to extreme poverty in 24 countries in the middle of the nineteenth century. The third is a modelling effort for the South Korean economy used as a laboratory to explore the probable efficacy of a large variety of major, but non-revolutionary strategies, policies, and programs for the alleviation of poverty in the medium run" (Adelman *et al.* 1976, p. 561).

CROSS-SECTION STUDY

This study used 1957-68 data for 43 underdeveloped countries. Interactions among economic and social structure and change was related to the distribution of income as measured by the share of the poorest 60 percent, the middle 20 percent, and the upper 5 percent of the population. Table 3 presents the results. The authors stress the negative outcome - "the paucity of potentially relevant influences that proved to have systematic relationships to variation in shares" (p. 562). This applied to most of the conventional economic variables economists stress as well as the social variables.

Some of the variables chosen for inquiry as shown in table 3 touch on aspects of human communication but as in the case of the sectoral studies there is no useful treatment of, perhaps no reflection of the hypothesis that the changes in income distribution could be related to the informational efficiency of the system. Here again the methodology lends itself to such inquiry.

HISTORICAL ANALYSIS

This analysis of economic growth and impoverishment in the middle of the nineteenth century used data for 24 countries where some significant economic change took place between 1850 and 1914 and for which adequate data were available. Adelman *et al.* reported as follows:

Several major hypotheses emerge from our historical study of the processes that generate poverty. First, the inherited constraints on economic structure that most affect the incidence of poverty in low-level agricultural economies are the abundance of accessible agricultural resources relative to population and the nature and structure of landholding institutions. Second, the relationship between the level of economic development and the extent of poverty is complex and non-linear with extreme poverty possible both at very low and at higher levels of development. Third, any kind of structural change such as industrialization or commercialization tends to increase poverty among the poorest members of the population. Furthermore, in the early stages of development, the increase in poverty tends to be quite large unless the change is sufficiently slow and of such a kind that the population whose activities are displaced or marginalized can be reabsorbed into expanding sectors of the economy. Our study suggests the hypothesis that both rapid

TABLE 3. SUMMARY OF RESULTS OF ADELMAN-MORRIS
CROSS-SECTION STUDY OF INFLUENCES ON THE DISTRIBUTION OF INCOME

	Direction of relationship*			Frequency of significance		
	Bottom 60 percent	Middle 20 percent	Top 5 percent	Bottom 60 percent	Middle 20 percent	Top 5 percent
<u>Potentially effective</u>						
Rate of improvement in human resources	+	+	-	1	2	1
Direct government economic activity	+	0	-	1	0	3
Socioeconomic dualism	-	-	+	1	1	1
Potential for economic development	-	+	0	1	2	0
Per capita GNP	-	0	-	2	0	1
Strength of labor movement	-	+	-	1	1	1
<u>Moderately effective</u>						
Abundance of natural resources	-	0	+	1	0	1
Factor scores on level of socioeconomic development	0	+	0	0	2	0
Structure of foreign trade	+	+	0	1	1	0
Importance of indigenous middle class	0	+	-	0	1	1
Character of agricultural organization	-	+	0	1	1	0
Political participation	0	+	-	0	1	1
Political strength of traditional elite	-	0	+	1	0	1
Level of modernization of industry	-	+	0	1	1	0
Literacy	0	+	0	0	1	0
Degree of cultural and ethnic homogeneity	-	0	0	1	0	0
Leadership commitment to economic development	0	-	0	0	1	0
Effectiveness of financial institutions	0	-	0	0	1	0
Urbanization	0	+	0	0	1	0
<u>Not effective</u>						
Adequacy of physical overhead capital						
Rate of population growth						
Total population						
Level of modernization of agricultural techniques						
Improvements in agricultural productivity						
Change in degree of industrialization						
Size of the traditional agricultural sector						
Rate of growth of per capita GNP						
Level of effectiveness of tax system						
Improvements in the tax system						
Improvements in the effectiveness of financial institutions						
Country size and orientation of development strategy						
Extent of social mobility						
Type of colonial experience						
Length of experience with self-government						
Political strength of the military						

*Where a variable is significant at more than one split in a single analysis, the sign refers to the first split.

Source: Adelman et al., p. 563.

commercialization and rapid industrialization systematically depressed the standard of living of the poorest stratum of the population in the early part of the nineteenth century. Finally, the structure and processes of economic activity matter most in determining the incidence of poverty; the structures of production, the market sector, and the labor force; the processes of technical change, commercialization, and population growth. (Adelman *et al.*, p. 565).

The discussion of these hypotheses does not directly involve communication processes. This conclusion is supported by the following list (p. 568) of structural influences and processes deemed to contribute to poverty:

Displacement of small agriculturalists because of agricultural commercialization

Displacement of craft workers because of domestic industrialization

Displacement of craft workers because of foreign imports

Unemployment or underemployment because of surge in population growth greater than growth in employment opportunities

Overcrowding of urban informal sector

Cyclical unemployment

Factory wages below subsistence

Urban foreign immigrants

Pressure of population on agricultural resources

Low productivity per worker in agriculture

Natural disasters

Parcellization of cultivating units

Slavery/self labor/de facto bonded labor

Exploitative landholding institutions

Agricultural indebtedness associated with commercialization of agriculture

Wages of agricultural laborers below subsistence

Domestic violence

Stated in very broad terms the study implies that "all kinds of structural change hurt the poor" (p. 568). Adelman *et al.* elaborate on this point:

A leading hypothesis emerging from our study is that during the first half of the nineteenth century, the spread of mechanized techniques and the spread of markets in agriculture systematically increased poverty among the poorest segments of society. The salient features of comparative experience during that period suggest the following model of the key interactions contributing to increased poverty. The extent of increased poverty depended on the nature, strength and pattern (regional and sectoral) of two processes associated with structural change: first, the process of displacement of one set of economic activities by another as a result of modernization or technological change; and second, the process of expansion associated with the introduction of new economic activities. The impact of structural change on poverty depended upon the net balance of the two processes. Interacting with these processes were national and regional patterns of population growth and migration (p. 568).

The analysis clearly needs to be carried to greater depth. If the poor are poor because they suffer from inferior knowledge, restricted access to information sources, and lower information processing capacity, it is no surprise that the poor are disadvantaged by structural change as the process of structural change commonly called economic development is characterized by transition through successive information states. Structural change inevitably has redistributive consequences and the gains tend to flow to those with superior or prior knowledge or

better luck. "By not holding people liable for all the effects of all their actions, American society widened the scope of free individual actions, but at the same time it forfeited the kind of security and order that can exist in a stationary economy. In a free market economy the race was to the swift - and, of course, to the lucky, for even the swift sometimes ran in the wrong direction (Higgs, 1971, p. 125).

KOREAN MODEL OF INCOME DISTRIBUTION

The Korean model was "designed to provide a laboratory within which one can explore the potential impact of standard economic policy constraints and programs intended to improve the relative and absolute incomes of the poor" (p. 570). The distinguishing features of the model are:

it solves for prices endogenously in both factor and product markets;

its solution is based on achieving a measure of consistency among the results of individual optimizing behavior by a large number of actors (households, firms);

it incorporates income distribution, monetary phenomena, and foreign trade;

it is dynamic, with imperfect intertemporal consistency; and

it allows for varying principles of market clearing and institutional behavior (p. 570).

The general intention was to achieve a dynamic model that gave a more realistic specification of actual growth than is provided by an inter-temporally efficient equilibrium growth model. The result is described as "a kind of 'lurching equilibrium'" (p. 575).

The conclusion is not encouraging to those wishing to achieve redistribution:

On the whole, our results underscore the difficulties of effective policy interventions to improve the distribution of income. They emphasize the magnitude of the policy effort necessary to avoid rapid erosion of benefits. Since individual programs tend to be considerably less effective than packages of programs, and the benefits of most single-pronged interventions rapidly trickle up a big-push balanced strategy appears to be best. However, a successful big push requires major government intervention and large implicit and explicit economic transfers. Therefore, the implementation of a successful anti-poverty program would entail either a change in the ideology of the ruling classes towards explicit egalitarian concerns or a certain degree of centralization of authority in order to overcome resistance by the rich, or, most likely, a combination of both. The problem would then remain of reducing the power of the centralized authority once its basic job is done (p. 578).

Taking the results of the set of studies together, there is an emphasis on the combination of strategy and process. Against the background of these studies Adelman (1976) takes the view that rapid depauperization requires the redistribute-and-educate-first strategy on a wide scale (p. 308). The 'package' is made up of "resource redistribution, massive education, and labor-intensive growth policies" (p. 309). While the evidence remains questionable because the entire process is so complex, the data inadequate, and the measurement problems enormous, the models and planning strategy suggested pose two questions for those interested in communication planning. First, is communication labor-intensive? Secondly, can analyses such as those of Adelman *et al.* be modified to take explicit account of the role of communication?

PAUL STREETEN

Streeten (1974) is summarized as follows:

The scope and the limits of the use of transfer of development research are discussed and the question is raised what social, political, philosophical and moral problems arise when scholars from rich countries, with well-endowed centers of learning, carry out research on and in substantially poorer countries. The charges are examined that have been made by developing countries against research on their problems and in their territory, and in particular the charge of intellectual imperialism. Different arguments for collaboration in research between rich and poor countries are distinguished. There is a discussion of interdisciplinary research and its organization. Some of the issues are illustrated with the aid of an example: research on poverty eradication and strategies for greater (efficient) equality. The question is raised whether research in rich countries should confine itself to the 'interface' of the rich poor relations or whether development research is an indivisible whole (p. 11).

The issues raised by Streeten will continue to be debated. Here his definition of technology merits attention for he treats the social sciences "as a form of (intellectual) technology" (p. 11). The social science output would, on this view, be part of the information sector. Social science activities might then be expected to be governed by the same forces as other forms of technology. Kornai's propositions, for example, should apply to social science information structures.

NATIONAL ACADEMY OF SCIENCES

The National Academy of Sciences sponsored an inquiry into appropriate technology for developing countries (Eckaus 1977). It was prepared by "a panel broadly representative of current knowledge and practice on problems of technological choice, utilization, adaptation, and transfer" (p. viii). Dr. Simon Teitel's comments from the appendix follow:

While I must side with Professor Richard Eckaus on the matter of "intermediate" (between what?) technology, as well as the inconclusiveness of much of the research done so far on this topic and on the question of technological determinism and quality of life, I must take exception to his basic approach. My main criticism is with the conceptual framework about technology used in the report. While there is some awareness in the paper about the limitations of received economic theory, the method used is still essentially reductive, and technology is for the most part only conceived as technique (i.e., factor proportions) and as a datum, a given to the economic system. This, as Stigler stated, assumes away the problem of choice of technology, *American Economic Review*, March 1976 (see G. J. Stigler, "The Existence of X-efficiency"). As a consequence, we have a statement which deals mostly with the choice of sector and product rather than technology. In fact, it has already been obvious from previous work in this field that we need to treat the subject of appropriate technology from the point of view of restrictions to the flow of information, considering both international and domestic institutional constraints (see K. Arrow, "Limited Knowledge and Economic Analysis," *American Economic Review*, March 1974). Instead, the standard two-factor neo-classical model is followed, and as a result no mention is made of such crucial factors as materials, scale, and inappropriate machinery. Although there is some discussion about the transfer of information of a technical nature, the analysis is limited essentially to the flow of information from outside the LDCs, and is lacking in regard to the economics of information. Little is said also about the adaptation and development of technologies in LDCs.

A further problem I have with the paper, also conceptual, is with the meaning ascribed to "appropriate." There are here two basic possibilities, both relevant: "appropriate" to objectives and "appropriate" to the environment. Eckaus deals only with possible criteria for appropriateness from the point of view of alternative growth objectives and does not consider the adequacy of the technology to specific factor endowments, informal restrictions, and other institutional aspects of LDCs. This constitutes not only a problem in itself but is in part responsible for the lack of sufficient emphasis on the extent of adaptation of technology going on in LDCs.

YOTOPOULOS AND NUGENT

The superb review of the economics of development by Yotopoulos and Nugent (1976) opens with a discussion of the record of economic development and the disillusionment with development economics. They seek to dispense with the theoretical work that still lacks supporting evidence:

Theoretical analysis seems to have grown entirely independently of the accumulation of empirical findings. As a result, there are development theories that have largely remained devoid of empirical content, especially of hard corroborative evidence; and on the other hand, there are bodies of empirical findings that are still in search of a theory. We attempt to bridge this gap by dealing exclusively with empirical hypotheses in the economics of development—that is, with alternative propositions among which one can discriminate by reference to the facts (p. xxi).

Communication and knowledge do not rate index entries. Slack can exist in the economy because of limited information (p. 77). The information generated by quantitative signals may be relatively more important signalling devices than prices (p. 142). There are information aspects to job search models that have implications for dual economy models (pp. 230-232): Chapter 11 examines the role of human capital. Incomplete information may create "a defeatist attitude toward project appraisal" (p. 377). These would constitute a small reward for searching such a large volume were it not such an able review of empirical investigations. To the extent that communication services or information generally can be treated as another "commodity," the achieved framework of the economics of development that has been subjected to the test of empirical inquiry and reviewed by Yotopoulos and Nugent is available and applicable. The basic notions of a production process, efficiency, capital formation, sectoral change,

and even equilibrium can be of use. Important questions are as yet unanswered. Does such a treatment capture the real contribution of information? How important are those aspects of information that are not shared by other commodities? The structuralist viewpoint is important and yet it must be merged into an evolutionary mode of thinking.

Schumpeter thought in such a fashion. Society's "stock of goods," he said, "is neither homogeneous nor an amorphous heap. Its various parts complement each other in a way that we readily understand as soon as we hear of building, equipment, raw materials and consumers' goods. Some of these parts must be available before we can operate others; and various sequences or lags between economic actions impose themselves and further restrict our choices; and they do this in ways that differ greatly according to the composition of the stocks we have to work on" (p. 631). Brief reflection suggests that information technology is treated as if it does not differ from manufacturing technology. Appropriate questions would be: How do the various kinds of information, both stocks and flows, complement both each other and other resources? Are these complementary relationships readily understood as soon as books, data bases, computers, land lines, and satellites are mentioned? Which parts must be available before others can be operated? What are the sequences and lags imposed by modern information technology? The answers are largely negative. This should not occasion surprise as there is an element of truth in the accusation that economists have sought to analyse manufacturing using a production function concept derived from nineteenth century agriculture.

CHAPTER 5: INHIBITING INFLUENCES AND INNOVATIONS

There are few discussions by economists of the role assigned to communication in development theories. Melody (1976) concludes that communication planning has not been integrated into development planning in either development or developing countries.

Unfortunately, analysts, policy makers and development planners know very little about the effects of specific kinds of expanded communication in the development of any nation at any particular juncture in its evolution. And an expansion of particular kinds of communication facilities, services or opportunities on the basis of faith alone is a risky policy at best. The fundamental problem is that the role of communication in development has not been made operational and integrated into development plans. The significance and importance of various kinds of communication for different kinds of development is known in only vague and impressionistic terms. The relationships between the communications sector and other sectors of society have not been developed. The short-term and long term, contributions of communications systems and services have not been measured. Alternative ways of integrating communications into the development plans of a nation have not been assessed. The past, present and potential contribution of communications for development cannot be compared effectively to that of other sectors of society. Hence, it is not known how communications should be evaluated in the resource allocation decisions of national governments (Melody, pp. 3-4).

Melody's major contentions are:

- Modern microeconomics in the neoclassical tradition focusses on static economic efficiency questions on the assumptions of given resources and given consumer preferences. Its equilibrium analysis base assumes "perfect knowledge of all relevant information" (p. 7). Such analysis cannot cope with time and knowledge change. The sequential process labelled development was of necessity treated as the consequence of exogenous shocks to the system.
- Although the neoclassical theory did not address the dynamic problem of long-run development, it provided apparent theoretical support for two fundamental policy prescriptions regarding development. First, free trade was presumably in the interests of the trading nations, so there was no reason to restrict trade in the interest of national development. Second, economic growth and development come about as a result of external shocks to an equilibrium situation This view assumes that economic development will occur when externally supplied capital, technology, expertise, information, etc., are injected into a developing country, bouncing it to a new equilibrium position - presumably at a higher plane - which will be optimal under conditions of free trade (pp. 8-9).
- The broadening of the economists' concept of development to encompass advancement of the entire social system accentuates the problems both of devising a theoretical framework for development analysis and examining the role of communication in development.
- Communications can be viewed in several ways: as an investment alternative; as provision of part of the economic infrastructure; as new technology; and as a policy instrument.
- Network aspects of communication must be studied (pp. 16-18).
- A systems approach must be adopted because this would enable communications to be treated as endogenous and development to be viewed as a process [It] will recognize communications as an integral part of

a nation's development system, and a nation's development system as conditioned by the international environment in which it must thrive (p. 20). "Under a systems approach, development can be examined as a dynamic process where cause and effect is not unidirectional and sequential, but circular, interdependent and iterative. Time can be specifically recognized as an important variable in development models and cumulative effects can be considered (p. 21).

- A systems approach will help replace the fragmented planning processes that currently characterize much communication planning.

Melody's contribution is a valuable one. There are, however, some comments that might be offered. The inhibiting influences that have lead economists to resort to the perfect knowledge assumptions go deep in modern thought. It is true that this viewpoint was, in a sense, necessary because of the lack of good measurements. Knowledge activities were not amenable to precise productivity calculations. It was easy to see knowledge as a "free good", akin in some respects to natural resources and especially under capitalism, Schumpeter's "civilization of inequality and of the family fortune" (cf. Lamberton 1975, 1976), those in foreign lands.

To speak of a systems approach does not solve the problem. It is simply a direction to take a new and unexplored path. Great efforts will be needed in this exploration. The magnitude of the task can perhaps be indicated by raising a further line of criticism of Melody's treatment of 'economics'. Static equilibrium thinking may have dominated for a long time but there have been exceptions to this tradition. Gourvitch (1940) has surveyed economic theory on technological change and employment. Lamberton (1974b) has added a brief addition. Important names are Marx, Marshall, and Schumpeter but there are many others - Stewart, Babbage, Rae, Hearn. These people have sustained a tradition of an evolutionary economics and, more specifically, have endeavored to treat technological change as endogenous. Their approach has been emphasized in recent writings, several of which will be reviewed below. The relevance to Melody's paper is that despite these efforts, which have appeared under the labels of evolutionary growth models, economics of technological change, or economics of information, much work clearly remains to be done. Adoption of these alternative models of thought can take place only with awareness that they are available and with recognition of the social issues that make necessary the change from conventional models.

R. L. MEIER

Meier (1960) noted the early impact of information theory and information technology. He wished to explore "this promising frontier" (p. 98) because he sensed its importance in modern economics and expected that it would lead to modification of their development strategies.* He introduced his basic notions in the following manner:

Philosophers are prone to point out when participating in interdisciplinary seminars that a natural resource owes its existence to a body of human knowledge. The peculiar quirk of Nature now labeled as a resource would not be recognized as an opportunity for enrichment were it not for a block of experience shared by specialists that is now simply called "know-how".

A resource, it must be remembered, cannot come into being without the prior evolution of an art or a technology to exploit it. Therefore, the study of changes in volume of resource availability and use might profitably concentrate upon changes in the state of knowledge. Since information must circulate prior to utilization, the study of the content of these communications should enable us to see the potentials that the future holds forth. There is a good chance that the picture so obtained would be far more explicit than one derived from the statistics covering resource use when taken by themselves, even when the latter is extrapolated into the future with the best available techniques (Meier, p. 99).

Knowledge about resources could take many forms and economists had avoided the problem of quantifying the state of knowledge. Quantitative assessments of resources reserves and their rate of utilization, e.g. the Paley Report, had made assumptions about the knowledge of technology. Meier proceeded to reverse the process: "The flow of information, and changes in the state of informedness, are made the independent variables, and economic magnitudes then become the dependent variables" (p. 100). Economic growth would have been preceeded by expansion in communications in the sectors that subsequently grew. Because the innovations resulted from a number of simultaneous efforts - a Schumpeterian swarm - Meier was led to conclude that "The flows of 'basic', or

* His ideas were developed and applied in Meier (1962) and Meier (1966) - the first edition of the latter had appeared in 1956. For present purpose the 1960 paper is the best presentation of the conceptual aspects.

background information must have pervaded a large share of the society" (pp. 100-101). The general proposition deduced was that "Increases in the flow of information may serve as a predictor of economic growth" (p. 101). Other propositions advanced were:

- Increases in publicly available knowledge enhance substitutability of resources.
- Transportation inputs are being replaced by communication inputs.
- The producer-consumer dichotomy may be replaced by the sender-receiver relationship.

Both Meier and the discussant of his paper (Joseph L. Fisher) deplore the neglect of communications compared to transport and other economic activities. Because the occasion was comparatively recent, it is worth noting Fisher's remarks.

Walter Isard and others have gone a good distance toward integrating the space factor into the general body of economic theory through the elaboration of such concepts as the "distance input" (ton-mile cost) as one of several input factors. This has been done empirically, for example, with reference to the transportation of coal, iron ore, and limestone, in the production of steel and the transportation of steel and its products to markets. No attention, so far as I know, has been given to the flow of communications as part of the system whereby steel is produced and its products placed in the hands of consumers. There would appear to be no reason why communications could not also be regarded as input to be economized and blended with other inputs. Meier's idea that "matter is endowed with increasing information as it proceeds from stage to stage on its way to becoming a finished artifact" is an intriguing one. This property, too, would have to be taken into account in any expansion of theory to include the communications element.

This might be regarded as a brief description of Porat's treatment of the information aspects described in Chapter 7.

NORTH AND THOMAS

To North and Thomas (1970) economic institutions are variables in their study of long-term economic growth. An institution is defined as "an arrangement between economic units that defines and specifies the ways by which ... units can co-operate or compete" (p. 5). Institutional change, like product and process innovation, comes about when decision-makers deem it profitable to undertake the costs of bringing about such changes.

Potential benefits that historically have induced institutional innovations and thereby actually raised the productivity of society result from (1) economies of scale, and (2) reduction of transactions costs, which best can be viewed as the costs of operating an economic system. The latter in turn can be separated into the costs of externalities, of information, and of risk. Both the realization of economies of scale and the reduction of transactions costs have been significant sources of profit to groups undertaking institutional rearrangement (pp. 5-6).

Economies of scale and externalities have received a good deal of attention. "A less explored aspect of transactions costs is that of organizing and improving the flow of relevant economic information, yet this has historically been a major area of institutional innovation" (p. 6). This theme calls for some elaboration.

If there were no costs to acquiring information then prices in all markets would differ only by transport costs. In fact, information is costly and the widespread existence of purely local markets reflect in good part simply the lack of information about profitable trading opportunities in more distant areas. The development of such information meant that merchants would send their products to the markets where net price differentials (i.e. prices adjusted for transport costs) were highest; thus the development of institutions to increase the flow of information increased the merchants' profits. The development of the whole network of trading institutions - merchants, brokers, factors, supercargoes, early exchanges in coffee houses, stock and commodity exchanges - were all directed basically to this end. Eventually, it became profitable to produce and sell this information in such forms as price currents or trade association journals. Like the two previous sources of institutional innovation, these were not only privately profitable to the merchant and entrepreneur but by arbitrating markets were a major source of productivity increase and economic growth in the Western world.

The prevalence of risk - the inability to be certain of the terms on which future transactions can be made - is yet another cost limiting the extent of transactions. The possibility of very high losses on an individual transaction will inhibit such enterprises even though when averaged out over a sufficient number of under-

takings the average rate of return may be very high indeed. The creation of institutions to spread risks would clearly make it possible for entrepreneurs to realize these higher rates of return without the risk of disastrous consequences when an individual venture failed. The early share-partnership in shipping and trade, the joint-stock company, and insurance associations (such as Lloyd's of London) were created precisely to capture the profits from such high-risk ventures. Since the high potential profits mirrored the social rate of return, the development of such institutions to spread risk also led to productivity increase. We should note in passing that many institutional innovations were created both to increase information and to spread risks (many types of financial institutions, futures markets, etc.) (North and Thomas, pp. 6-7).

It should be noted that the extension of national and international markets has worked strongly to foster institutional innovation. "Transactions costs tend to be subject to economies of scale" (p. 9) and this tendency has been reinforced, at times in spectacular fashion by technological change.

What of the relationship of these changes to the process of economic development? North and Thomas emphasize that institutional innovation does not necessarily lead to growth:

Some institutional changes lead to the redistribution of income and actually reduce output. The history of ancient civilizations as well as of most underdeveloped economies today bears witness that it has often been more profitable for entrepreneurs to develop institutions to redistribute income than to innovate productivity-raising institutions. The essential key to our essay is that cumulative changes in secondary institutional arrangements ultimately led to a restructuring of fundamental institutions in Western Europe over this period, in such a way that individuals in the society were now encouraged to strive for greater productivity in their economic undertakings. New incentives had arisen in the form of increased private profitability of innovation and improvement in the quality of factors of production. To put it more specifically, while the social rate of return on innovation and capital formation (both human and physical) had always been high, changes in organization and property rights increasingly brought the private rate of return accruing to individuals and groups nearer the social rate of return. Growing efficiency was the inevitable result (North and Thomas, p. 10).

GEORGESCU-ROEGEN

Georgescu-Roegen (1971) begins with the proposition that "the economic process is not an isolated system" (p. 316). He acknowledges that "the economic domain is surrounded by a dialectical penumbra far wider than that of any natural science" (p. 317). He is critical of the modern formulation that defines economics as the study of how given means are applied to satisfy given ends because "any system that involves a conservation principle (given means) and a maximization rule (optimal satisfaction) is a mechanical analogue" (pp. 318-9). The results of such a system he sees as valuable. Nevertheless, this "new field of engineering (or managerial) economics does not cover the whole economic process any more than husbandry exhausts all that is relevant in the biological domain" (p. 319).

"The question", says Georgescu-Roegen, "is why a science interested in economic means, ends, and distribution should dogmatically refuse to study also the process by which new economic means, new economic ends, and new economic relations are created" (p. 320). Contrasting economics with the example of husbandry, he concludes that "The reason is that the evolutionary pace of the economic 'species' - that is, of means, ends, and relations - is far more rapid than that of the biological species. The economic species are too short-lived for an economic husbandry to offer a relevant picture of the economic reality. Evolutionary elements predominate in every concrete phenomenon of some significance and to a greater extent than even in biology. If our scientific net lets these elements slip through it, we are left only with a shadow of the concrete phenomenon" (p. 320).

NELSON AND WINTER

Nelson and Winter (1974) and Nelson *et al.* (1976) illustrate the significant effort to model Schumpeterian evolutionary economic change. The authors contrast their evolutionary approach with a neoclassical perspective by reference to "one of the ancestral papers" of their present efforts (Nelson 1968). The neoclassical theory "assumes universal access to the same technology, that firms choose optimally, and looks to factor supply differences for the explanation of productivity differences. In contrast, the diffusion model treats economic development as an adaptive, not a maximizing, process and views both growth and cross-country productivity differences in terms of a pervasive disequilibrium. It is not a matter of different positions on the same isoquants; it is a matter of evolutionary change in the mix of firms of very different types" (Nelson *et al.*, p. 93).

The neoclassical approach has yielded important results. The "research [it has spawned] ... has served principally to establish the need for a richer analysis of the sources and effects of technical advance and of factor quality improvements" (Nelson and Winter, p. 888). As Nelson and Winter point out, the historians and students of industrial organizations have been engaged in this process of richer analysis. Their efforts have been reinforced by work in related fields: e.g. economics of information and organization studies. The problem of reconciling the findings of such research with the neoclassical viewpoint or, alternatively, developing the 'new' evolutionary models to a fully effective stage, is so important that the detailed comments of Nelson and Winter will be quoted.

The problem here is more than inability of the theory, at least in simple form, to be useful to certain kinds of research, and goes beyond the fact that there are some interesting data that are difficult for the theory to digest. Research within the neoclassical theory now acknowledges the centrality of technical change in the growth process. The "indigestible" phenomena appear - the minute the neoclassical blinkers are removed - to be basic characteristics of the technical change process.

The recent survey articles do not confront this problem squarely. Nadiri sidesteps it largely by ignoring the micro literature on technological advance, despite the importance he attributed to technical change. Pavitt ignores the macro literature. Mansfield leaves the tension between the two literatures unanalysed. However, the organization of the recent article by Kennedy and Thirlwall does make the division explicit. The analytic structure used in the first part of the survey, on the effect of technical change, is predominantly neoclassical growth theory. There is an explicit or implicit commitment to the assumptions of faultless maximization and equilibrium. Very few of the studies of the second part of the review, concerned with the processes of technical change, employ these assumptions. Several of these studies (for example, the models of diffusion) implicitly deny them.

In another recent article appraising the state of growth theory there is sharper awareness of the problems. Nordhaus and Tobin remark:

"The (neoclassical) theory conceals, either in aggregation or in the abstract generality of multi-sector models, all the drama of the events - the rise and fall of products, technologies, and industries, and the accompanying transformation of the spatial and occupational distributions of the population. Many economists agree with the broad outlines of Schumpeter's vision of capitalist development, which is a far cry from growth models made nowadays in either Cambridge, Mass. or Cambridge, England. But visions of that kind have yet to be transformed into theory that can be applied to everyday analytic and empirical work" (1972, p. 2)

But much of the research within the economic history and industrial organization traditions has been concerned with just that drama.

The focus of the Nelson modelling is on the evolution of production techniques over time. The new element is basically a "behavioral" treatment of the question: Why is the firm at any time using the technique it is using? (Nelson *et al.*, p. 94).

A neoclassical answer would be that the firm has chosen its technique on the basis of profitability calculations comparing the elements of a large choice set (production function). A behavioralist's answer, and the one embodied in our model, is of a very different form. The production technique used by a firm at any time is regarded as a complex pattern of routinized behavior, of which the input-output coefficients are a quantifiable aspect. The firm is not seen as, at any time "choosing" its technique from a large choice set, but rather as "having" its technique. The technique may change over time as a result of search, but changes are typically small. When larger changes occur, it is likely because other prominent firms are using significantly different techniques, which thus provide a target for imitation. The forces of search are complemented, at an industry level, by forces of selection. Profitable firms expand. Unprofitable firms contract and are spurred to search harder, or more effectively (Nelson *et al.*, p. 94).

It would be premature to claim that the Nelson work is complete nor that the methodological problems have all been solved. Nevertheless, this initiative in the construction of evolutionary models holds distinct promise for the study of communication/information processes in both developed and developing countries. Despite the promise, the cautions must be noted. Nelson *et al.* conclude:

One way to interpret the message of the present paper is to regard it as underscoring the seriousness of the difficulty that is called, in a narrower context, the identification problem. Very different structures can generate similar statistical patterns; a world without a production function can, for example, mimic much of the behavior of a world that has one. Or, a world full of firms that can determine, approximately,

whether a proposed alternative is more or less profitable than the status quo may behave in some ways similarly to a world in which firms unerringly pick optimum positions from continua of possibilities. But a point that is either little known or taken very lightly is this: The identification problem is much exacerbated when economic reality is first divided into fragments for purposes of theoretical analysis, and the fragments are then intensively analyzed with the aid of assumptions that are justified primarily by the claim that the (fragmentary) evidence is patterned "as if" the assumptions were true.

In developing a special-purpose model for a particular fragment, the theorist denies himself the full benefit of available information on the structure of economic reality. This may not detract much from the ability to get good fits to a given data set, but it makes the predictive power of the model vulnerable to changes occurring in the neglected part of the environment. And the family of models and empirical findings thus produced is lacking in connectedness to a degree that severely limits its power as a tool for analyzing the coherent realities of particular industries or sectors. An appeal to the "as if" argument should be construed as an admission that the attempt to identify the true structure has been abandoned. The logic of the standard arguments in favor of trying to identify the true structure then applies, and the question is how much weight they are to be given in the particular substantive area involved. The issue is not "theory versus realism." What we have set forth and analyzed here is a highly abstract, drastically simplified theoretical model of a progressive economy. No one could confuse one of our simulated firms with, say, General Motors. We can only claim that certain empirical data are patterned "as if" General Motors and other real firms were like our simulated ones. But we invoke this argument at quite a different level than is typical in economic theorizing; our story is highly abstract, but clearly much less abstract than the stories theories usually tell. And concurrently with the change in the level of abstraction, we have thrown aside a large body of orthodox conceptual apparatus and introduced new concepts that seem to us to provide a superior language for discussing events at the lower level of abstraction. We have produced an account of economic growth and technical change that is simultaneously consistent (a) in quantitative terms, with the broad features of a certain body of aggregate data; (b) qualitatively, with such phenomena as the firm-size distribution, the existence of cross-sectional dispersion in capital-labor ratios and in efficiency, and patterns of innovation and diffusion of techniques; and (c) at least metaphorically, with the empirical literature on firm decision making. These fragments of economic reality, at least, need not be regarded as posing isolated problems to be addressed through special-purpose assumptions. The model's consistency with disparate types of data indicates, in our view, that it is not merely consistent with the data of any one type, but rather bears a fairly intimate relationship to "what is really going on out there" (Nelson *et al.*, pp. 117-8).

ROSENBERG

Rosenberg (1974) is an excellent illustration of the 'richer analysis' commended by Nelson and Winter.* He directly challenges the treatment of the process of technological change as an exogenous variable. Drawing on his own extensive studies of technological change and, in particular, Schmookler (1966), Rosenberg calls for "a more careful examination of the manner in which the state of knowledge at any time shapes and structures the possibilities for inventive activity" (1974, p. 95). Schmookler's thesis was that the composition of inventions was essentially a demand phenomenon and reflected on allocation of resources in response to demand-induced profit expectations.

Rosenberg's critique is interesting, more especially when related to the Nelson *et al.* work. His main objection is "that inventions are not equally possible in all industries. This is because there is a crucial intervening variable: the differential development of the state of sub-disciplines of science and bodies of useful knowledge generally at any moment in time" (1974, p. 106). He elaborates:

The perspective which I am suggesting, therefore, states that, as scientific knowledge grows, the cost of successfully undertaking any given, science-based invention declines - from infinitely high, in the case of an invention which is totally unattainable within the present state of knowledge, down to progressively lower and lower levels. Perfectly inelastic supply curves of invention gradually unbend and flatten out. (To what extent they flatten out is, of course, an empirical question, on which Schmookler has adopted the arbitrary and implausible extreme assumption of perfect elasticity.) Thus, the growth of scientific knowledge means a gradual reduction in the cost of specific categories of science-based inventions. The timing of inventions therefore needs to be understood in terms of such shifting supply curves which gradually reduce the cost of achieving certain classes of inventions. More precisely, we need to think in terms of a number of supply

* Reference should be made also to Rosenberg's *Perspectives on Technology* and his 1976 paper in the *Economic Journal*.

curves for individual industries, depending upon the knowledge bases upon which inventive activity in that industry can draw, and we need to understand more clearly the extent to which different "pools" of knowledge are potential substitutes in the inventive process. Schmookler's hypothesis states, in effect, that there is one supply curve for all industries and that the extent of substitution renders it unnecessary to look at supply conditions in individual industries. It seems to me that a clear articulation of the relations between science, invention and economic growth requires a critical examination of this assertion. The basic economic question, of course, is not an "either or" proposition telling us whether a particular technological achievement is or is not possible at a particular point in time. The economic question is: Given the state of the sciences at what cost can a technological end be attained? How does the state of individual sciences differentially structure the cost of society's technological options? Answers to these questions will carry us a long way towards a deeper understanding of both the nature of inventive activity and the process of economic growth by providing further insight into the economy's changing capacity to respond to economic needs (pp. 107-8).

The contributions examined in this Chapter have been of broad scope. They have in common the aim of analyzing the dynamic processes of the real world. What may prove to be the most important innovatory thrust in this direction, the economics of information, is reserved for Chapter 6.

CHAPTER 6: THE ECONOMICS OF INFORMATION

This seems an appropriate point to review developments in the economics of information. After a slow start, work in this field is burgeoning--and Hicks' successor in the Drummond Chair of Political Economy at Oxford began his lectures in 1977 on information theory/economics overlaps. It is true that the American Economic Association classification system for articles and abstracts, as used in the Journal of Economic Literature, has no separate entry for "information": in 1976 "and information" was added after "Economics of uncertainty." Nevertheless, some general manifestations of interest or entry points to discussion might be noted.

ECONOMIC THEORY

Hahn in his Cambridge inaugural lecture had this to say (1973, p. 40):

I have also considerable confidence in my view that the main progress to be made now is to recognize quite explicitly the essentially sequential structure of the economies which we study and to wrestle with some of the very serious conceptual problems which this raises. In particular the distinction between the perceived environment and the environment and the consequential importance of the theories which are held by agents seems to me bound to become increasingly important in analysis . . .

He also pointed to the lack of "an adequate theory of learning . . . or of routine formation" (p. 33).

One might suggest that information processing is fundamental to "the distinction between the perceived environment and the environment" and to learning or routine formation. The work to be undertaken calls for either a very wide definition of economics or recognition that an interdisciplinary effort is appropriate.* The likely diversity here can be illustrated by the relationship between economics and linguistics (e.g. Rossi-Landi 1975) and organization theory (e.g. Arrow 1963). Which is the best base from which to launch this operation? 'The neo-classical edifice' is one possibility; theories of the Austrian school provide another. Lachmann (1976) has argued that Shackle's critique justifies an attempt to build upon the work of Mises and Hayek. Despite the unsettled nature of this debate (e.g. Boland 1970, 1974; Newman 1974, 1976; Kregel 1976), much attention is being given to the role and design of institutions in relation to the informational efficiency of economic systems (Kornai 1971; Hurwicz 1973; Pryor 1973, 1977; Havrilesky 1974; and Newman 1976). Attention has been directed not only to the system as a whole but also to internal organization as, for example, in the Symposium on the Economics of Internal Organization featured by the Bell Journal of Economics in 1975 (see Appendix A).

An important effort has treated information as a screening device (Akerlof 1970, 1976; Arrow 1973a; Spence 1974a; Stiglitz 1974, 1975; Grossman and Stiglitz 1976; Riley 1976; Salop and Salop 1976; and Reiter 1977). Screening is the identification of quality differences among individuals, securities, motor cars, or other goods and services. Screening devices provide information about these differences. Will too few resources be allocated to obtaining such information? Stiglitz contends that screening differs from cases in which the problem of appropriability in a market context traditionally is thought to lead to too little expenditure. "This is not the case,"

* cf. Dopfer: "Darwin's basic concept of the environment has to be reintroduced to all socially relevant sciences, including economics, in order to provide a breadth of empirical observation which allows the perception of problems in their complexity and the relating of single phenomena to each other in their proper quality of interdependency . . . This typically calls for interdisciplinary research" (1976, p. 9).

he says, "with the information provided by screening processes: individuals who can be labelled "more productive" are able thereby to obtain a higher wage, partly, however, at the expense of others. Thus, by its very nature, screening information has important effects on the distribution of income" (1975, p. 283). Starrett (1976) and Clague (1977) have pursued this theme. Stiglitz's general conclusion is worth noting: "Screening has productivity returns, but tends to increase inequality . . . [It] should be emphasized that whether there is 'too much' or 'too little' screening in a competitive economy depends on a number of assumptions concerning the screening technology, how well-informed individuals are concerning their own abilities, the nature of the production process, and whether screening is primarily hierarchical or 'job-watching'" (1975, p. 299, italics added). These relevant circumstances and the restriction to a competitive economy suggests there is scope for a great deal of empirical and theoretical work. Such work in due course might be brought to bear on a problem posed by Stiglitz. In another paper he used a distinction between two kinds of information: one associated with "R & D and the other with screening" (1974, p. 3). If the evaluation of the effects of screening depends in part on the screening technology, it might be argued that this might blur the distinction between the two kinds of information if screening technology is an output from the "R & D" process.

The screening or signalling development has led Blaug (1976, p. 850) to an interesting speculation about the future of human capital theory:

Nothing is easier than predicting the future course of scientific development--and nothing is more likely to be wrong. Nevertheless, let me rush in where angels fear to tread. In all likelihood, the human-capital research program will never die, but it will gradually fade away to be swallowed up by the new theory of signaling, the theory of how teachers and students, employers and employees, and indeed all buyers and sellers select each other when their attributes matter but when information about these attributes is subject to uncertainty. In time, the screening hypothesis will be seen to have marked a turning point in the "human investment revolution in economic thought," a turning point to a richer, still more comprehensive view of the sequential lifecycle choices of individuals.

Some other recent contributions concerned with screening, signaling, and searching are: Auld 1974; Nelson 1974; Rothschild 1974; Hirshleifer 1975; Hughart 1975; Cox 1976; Green 1976; Green and Laffont 1976; Kihlstrom 1976; Lippman and McCall 1976; and Marvel 1976. For some discussion of policies concerning information and regulation see Colantoni, Davis and Swaminathan 1976.

Before leaving this section one further contribution should be mentioned. Roberts and Holdren (1972 Preface*) offered "a new foundation for economic theory." They acted in the belief that "formal economic theory . . . cannot encompass the implications of imperfect information" and sought to create, using "the language and artifacts of stimulus-response learning theory," a system that "does permit learning and connects the consequences of learning to economic theory." They acknowledged that time and their colleagues would tell if their offer was a viable one. Six years have elapsed and the work has attracted little attention. Their analysis has incorporated learning although the treatment of costs is sketchy; it has an added advantage that it appears to facilitate efforts to subject time budget data to economic analysis.

ECONOMIC PLANNING

Killick points up the neglect of the role of information in development planning:

The existing stock of knowledge, the current flow of information, the capacity to absorb and interpret information--all these are gravely deficient in developing, and all other, countries. Economists are well aware of this but have failed to recognize its uncomfortable implications for development planning (1976, p. 173).

While it is appropriate that Killick extends his comment about information processing to all countries, to assert the importance of information and the relevance of the economics of information to planning does not provide a blueprint for action. On a local scene one might turn to the Report of the Royal Commission on Australian Government Administration. At many points (e.g. 3.7, 3.8, 10.2, 10.7) the Report touches on the production and dissemination of information. It incorporates (10.7.31) a recommendation for the establishment of a Commonwealth Information Advisory Council which would advise on:

* For related contributions see Anspath 1966 and Roberts 1973.

the development of policies for the generation and the efficient use of information within government administration, and for making the information available outside the administration;

desirable changes in the form and content of information made available by each of the . . . main sources;

desirable improvements in users' access to particular classes of information;

the priorities to be attached to proposed developments.

The Commission failed to deal with two basic aspects of the information question. First, it followed a familiar pattern in focusing on access or improving the flow of information. There is not enough consideration of "the capacity to absorb and interpret information" (cf. Lamberton 1977a. See also Kochen and Donohue 1976). Secondly, the Commission did not take up the problem of determining how much expenditure is justified for the improvement of information processing.* On these grounds alone one might share Hazlehurst's plea for a task force to follow up the Commission's work by considering "the information dimension as a whole" (1977, p. 130).

SOCIAL CHOICE

Another entry point to the discussion of the role of information is the Rawlsian concept of justice (Rawls 1971). Rawls develops his concept on the basis of two principles:

1. "Each person is to have an equal right to the most extensive basic liberty compatible with a similar liberty for others" (p. 60); and
2. "Social and economic inequalities are to be arranged so that they are both (a) to the greatest benefit of the least advantaged and (b) attached to offices and positions open to all under conditions of fair equality of opportunity" (p. 83).

Stated more generally:

"All social primary goods--liberty and opportunity, income and wealth, and the bases of self-respect--are to be distributed equally unless an unequal distribution of any or all of these goods is to the advantage of the least favored" (p. 303).

How can such a concept of justice be implemented? Rawls thinks in terms of a necessary state of original ignorance where individuals are not "in possession of morally irrelevant information" (Grout 1976, p. 137). He would argue that the rich person and the poor person cannot reach agreement because their relative wealth enters into the decision process. Therefore, the concept of justice must be that that would be acceptable in a prior state of ignorance--perhaps appropriately called perfect ignorance--in which no person knew their prospects in terms of social and economic benefits. Agreement is achieved because of a high degree of aversion to risk.

Various objections can be raised to Rawls' reasoning (See Grout 1976; McCreadie 1976). Here it will serve the purpose to quote a passage from Arrow (1973b):

One problem is that any actual individual must necessarily have limited information about the world, and different individuals have different information. Hence, they cannot possibly argue themselves back into an original position with common information, even if they succeed in "forgetting" who they are. Indeed, one of the most brilliant passages in Rawls's book is that on what he calls "social union" (520-530). He argues that no human life is enough to encounter more than a small fraction of the experiences needed for completeness, so that individuals have a natural complementarity with each other (a more mundane version of this idea is Adam Smith's stress on the importance of the division of labor). The social nature of man springs from this variegation of experience. But precisely the same differentiations imply differing and incompletely communicable life experiences and therewith the possible impossibility of agreeing on the just action in any concrete situation (p. 262).†

* Leontieff is reported (Aines 1975, p. 7) to have stated that U.S. Congressional interest in planning could be considered serious only if at least \$US250 million were allotted for the collection of information.

† That Arrow continues to pursue the same line of thought is apparent from a recent paper (1977): "The second difficulty is that reducing an individual to a specified list of qualities is denying his individuality in a deep sense. In a way that I cannot articulate well and am none too sure about defending, the autonomy of individuals, an element of mutual incommensurability among people seems denied by the possibility of interpersonal comparisons. No doubt it is some such feeling as this that has made me so reluctant to shift from pure ordinalism, despite my desire to seek a basis for a theory of justice" (p. 225). One might ask if the greatest "incommensurability among people" is not the difference in their knowledge.

This theme is deservedly receiving much attention (Daniels 1975; Phelps 1975; O.E.C.D. 1975). It is doubtful that either information theorists or economists persuaded of the importance of information processes will share Rawls' willingness to invoke a state of original ignorance. Such a reaction is not, of course, incompatible with agreement with the Spence-Stiglitz-Starrett view of the importance of information processes in the determination of income distribution.

BIBLIOGRAPHIES AND SURVEYS

Bibliographies and surveys in the 1970s begin with Lamberton (1971) and Olsen (1971). These should be supplemented by Cooper 1973; Lamberton 1974a; Spence 1974b; and Tomasini 1974. Other papers of a general character that might be consulted are: Hirshleifer 1973; Arrow 1974; Deutsch 1975; and Lamberton 1975. Rogers (1976) contains a valuable set of papers with emphasis upon the sociological and political aspects. There is a growing emphasis in the activities of the American Society for Information Science on economic aspects (See Husbands and Tighe 1975; American Society for Information Science 1977). To focus attention on some important brackets of papers, the tables of contents of the following have been attached as Appendix A:

Swedish Journal of Economics, vol 76 (1974), pp. 1-139. Papers presented at the Lund Symposium and related papers.

The Bell Journal of Economics, 6, 1 (Spring 1975), pp. 163-278. Symposium on the Economics of Internal Organization.

International Social Science Journal, 28, 3 (1976). Special issue devoted to economics of information and information for economists.

Quarterly Journal of Economics, 90, 4 (November 1976), pp. 591-666. Symposium: The Economics of Information.

Perlman, Mark (ed.), The Organization and Retrieval of Economic Knowledge (London: Macmillan, 1977). Proceedings of a conference held by the International Economic Association at Kiel, 1975.

RESEARCH

The recent research efforts are of diverse character. Three interrelated efforts should serve to illustrate.

OSIS/NSF

The Office of Science Information Service (OSIS) of the National Science Foundation (NSF) has recognized (1975) the economics of information transfer as a significant new topic within information science. The objective is to promote improvements in scientific communication and technology transfer through economic concepts and data. Priority areas of research include studies of the supply/demand and cost/benefit relationships of scientific and technical information services, analyses of the markets of such services, and, as data accumulates, development of simulation models. The initial projects included:

an investigation of Scientific and Technical Information indicators;

an expanded coverage of Scientific and Technical Information in updating Machlup's 1962 classic, The Production and Distribution of Knowledge;

research on the scale economies and public good characteristics of Scientific and Technical Information;

the inclusion by the U.S. Census Bureau of a question about Scientific and Technical Information expenditures on the national Survey of Industrial Research and Development; and

an analysis of the economic aspects of interactions between publishers and libraries.

Later projects have included:

A Critical Review of Research Related to the Economics of Scientific and Technological Information.

Evaluation of the Use of Computerized Scientific Information Services as a Replacement for Scientific Journals in the Chemistry Program of a Developing Undergraduate College.

A Study on Improved Dissemination and Use of Scientific and Technical Information.

Assessment of Scientific and Technical Information Use in the Public Sector.

Development of Statistical Indicators of Scientific and Technical Communication.

Development of Cost Benefit Methodology for Scientific and Technical Information Communication and Application to Information Centers Analysis.

A Policy Oriented Analysis of the Interaction of Law, Economics and Technology in the Use of Copyrighted Material in Scientific and Technical Information Retrieval Systems.

Evaluation of the Impact of Natural Resource Information on Land-Use Decision Making.

A Cost Benefit Model of Some Critical Library Operations in Terms of Use of Materials.

A Study of the Scientific Information Industry.

Grants made in 1975 totalled \$787,282 to which must be added continuing projects from 1974 and many closely related projects in other OSIS programs, e.g., a project on Economics of Computer Communication Networks at Stanford for which \$173,500 was provided in the general research program.

INFORMATION SECTOR ANALYSIS

The notion of an information sector as a component of the economic system rather than an alternative view of that system has been supported on several grounds. First, as a component it appears to be of considerable magnitude and to have experienced a high growth rate in those countries for which data are available. Secondly, the impact of and dependence upon modern information technology is widespread. The (London) *Economist* (1977) has recently stressed the ubiquitous nature of the computer/telecommunications partnership. Thirdly, there has been some concern, perhaps of low-key character, that traditional categories of income distribution analysis have become out of date (cf. Johnson 1964, pp. 221-222; Lamberton 1972, p. 209). If so, this kind of recognition of the information revolution might find a place in theoretical and empirical work relating to income distribution. Machlup's pioneering work on the U. S. economy has been extended by Porat (1977). A summary statement of his approach was provided in Chapter 2 and Appendix B1 shows the detailed typology of the primary information sector. Appendix B2 summarizes some of the more important results of Porat's work. Appendix C sets out some work-force measures that have been produced for U. K. (Wall 1977); Australia (Barnes and Lamberton, 1976; Lamberton 1977b); and West Germany (Lange and Rempp 1977).

O. E. C. D.

The O. E. C. D. has a long-standing interest in both science policy and informatics. With its Conference on Computer/Telecommunications Policy (1976), this interest was widened and the concept of an information sector was included in discussion. In 1976 proposals came forward for a Macro-Economic Analysis of Information Activities and the Role of Electronics and Telecommunications Technologies (see Kimbel, 1977). This led to a meeting of a "Group of Experts" on April 21-22, 1977. The group made recommendations along the following lines:

The reference to "macro" should be deleted because both "macro" and "micro" approaches to the studies were essential.

The impacts of information activities and technologies were now profound and made economic analysis a matter of high priority.

The Working Party on Information, Computers, and Communications Policy (ICCP) had recommended that the Group of Experts should initially concentrate on:

defining the socio-economic dimensions of the growth in information goods and services; and

facilitating the development of the mutual consistency and comparability of the various national research projects in this field.

The Group of Experts proposed the following terms of reference:

- (a) to identify the types and order of magnitude of information activities, changes in information technologies, and their major economic and social implications;

- (b) to promote agreement on concepts, definitions, and methods for measurement of the developments described in (a) above;
- (c) to coordinate research carried out or envisaged in Member countries in this field in order to allow for international comparability; and
- (d) to prepare an analysis for the use of Member governments of relevant policy implications.

Three types of action were recommended:

The Information Sector Approach. This requires the development of and agreement on an inventory in order to extract the information sector from the conventional labor force statistics and national accounts.

Economic Analysis of Policy Issues. This includes analysis on an internationally comparable basis of the implications of information activities and changes in information technologies for:

- productivity changes and economic growth;
- changing composition of economic activities and their consequences for employment and industrial relations;
- information sector influence on balance of payments and international division of labor;
- pricing of information goods and services; and
- regional distribution of economic activities.

Other Comparative Studies. Comparative studies should be undertaken of some important aspects of the impact of information technologies to add to basic knowledge of the private and social costs of production and the pricing of information goods and services and the variety of processes by which new technologies are introduced and diffused, e.g.

- retailing of goods and services;
- health services;
- employment of women in the information sector;
- consumer use of information facilities.

The nature of these proposed actions is such that some can be initiated immediately, others clearly requiring the successful completion of prior work. Cross-fertilization of ideas should occur between Members involved in the separate tasks.

The Group of Experts proposed that, first, member countries be invited to explore the possibilities of preparing, within existing national accounting frameworks, information sector accounts similar to those now available for the U.S. economy, and report to the Secretariat; and secondly, the Secretariat, with the help of consultants, prepare, in the light of the responses received, a common set of principles for defining information activities and procedures for the preparation of information sector accounts; and thirdly, with regard to the economic analysis of policy issues and the other comparative studies, member countries be invited to explore the possibility of action and report, in due time, to the Secretariat. This project is continuing and should yield a report late in 1978.

This now wide-ranging critique of orthodox economics has been spurred by the obvious contrasts between perfect knowledge models and the reality in which major expenditures are incurred on education, advertising, R & D, and the storage, retrieval and transmission of vast quantities of information of enormous variety. Additional impetus has been gained from the spectacular advances of computer and communications technology. The combined efforts to modify existing theory, analyze the economic aspects of human information processing, and develop new theory relevant to the information society are providing the framework within which many of the earlier initiatives may now combine. The pioneering efforts of Machlup (1962) and Porat (1977) have now provided the first detailed statistical picture of the information society. The O.E.C.D. project and the work of other researchers will hopefully soon enable significant comparative studies.

It would seem that the economics of information is concerned with such pervasive aspects of society that its life as a separate subject should be short-lived. Either there will be a pendulum swing and attention will shift away from information processes or more probably, the discussion will be integrated with general economics which will hopefully be transformed for the better. As in the business world, takeover can be a test of success.

Lest the reader react that all this is very much concerned with developed economies and may have no relevance to developing countries, several comments might be made. Even if the sense of this proposition were correct, these models would be relevant to the developing countries insofar as the events and the research findings would bear upon the strategies of the developed countries. However, the proposition must be challenged. The growth of knowledge and the communication processes that are involved in that growth are so fundamental to development that the conceptual approach should prove applicable to all societies. As Kenneth Boulding has remarked, "The plain fact is that knowledge or something equivalent to it in the form of improbable structures is the only thing that can grow or evolve. . . . It is only information and knowledge processes that can get out from under the iron laws of conservation and decay" (1966, pp. 25-6).

Against this background the current discontent in the world of planning is examined in Chapter 7.

CHAPTER 7: DEVELOPMENT PLANNING: CURRENT DISCONTENTS

As Yotopoulos and Nugent emphasize, "Planning, at least in name, is widespread in both DCs and LDCs" (p. 397). What then is 'planning'? In the context of development aspirations and problems planning tends to take on a comprehensive character. Killick (1976) suggests that there is general agreement amongst planners that plans should meet the following specifications:

Starting from the political views and goals of the government, the plan should define policy objectives, especially as they relate to the future development of the economy;

It should set out a strategy by means of which it is intended to achieve the objectives, preferably translated into specific targets;

It should present a centrally coordinated, internally consistent set of principles and policies, chosen as optimal means of implementing the strategy and achieving the targets, and intended to be used as a framework to guide subsequent day-to-day decisions;

It should cover the whole economy (hence it is 'comprehensive' as against 'colonial' or 'public sector' planning);

In order to secure optimality and consistency, it should employ a more-or-less formalized macro-economic model (which, however, may remain unpublished), employed to project the intended future performance of the economy;

It typically covers a period of, say, five years and finds physical expression as a medium-term plan document, which may, however, incorporate a longer-term perspective plan and be supplemented by annual plans (Killick, pp. 161-2).

Seemingly more succinctly planning might be defined as "systematic charting by government of a desired course for national sectoral or regional outputs" (Spulber and Horowitz, p. 157).

The justification for planning turns for the most part on the inadequacies of an unregulated market economy. Imperfect markets, incomplete adjustments, interdependence of decision, the need to correct discrepancies between private and social valuations: all these are advanced as conditions requiring planning intervention. While it is true that the conditions believed to guarantee an optimal allocation of resources in a free market are far from fulfilled in developing countries, insufficient attention has been given to the conditions necessary to ensure the efficient performance of a planned system.

Planning has been embraced with enthusiasm in the expectation that growth and equity objectives can be attained:

Unfortunately, a good deal of this has been wishful thinking. Planning procedures, too, have suffered from obvious defects; important factors have been overlooked; inconsistencies have been introduced. As a number of market-oriented economists have noted, proper planning requires heavy doses of the very inputs that are generally extremely scarce in LDCs--such as information and the skilled practitioners who are able to process and analyze it. Therefore, planning may not be particularly well suited to the factor proportions of LDCs. Moreover, in terms of the ultimate test of performance, there does

not seem to be any clear-cut evidence that growth rates of income or income per capita are positively correlated with the resources expended in planning (Yotopoulos and Nugent, p. 398).

In the idealized version all planning constitutes acts of economic control to which information flows are basic. From a cybernetic viewpoint the planner or controller receives inputs of information in order to make decisions and coordinate activities. The controller's output is information to those who are involved in the implementation of those decisions. Spulber and Horowitz provide a good discussion (Chapter 2) of information selection, the nature and type of information flows within systems, and the value and cost of information in the context of both information and decision theory. Before going on to examine the possibilities of development planning, it should be noted, first, that much of this information theory-inspired work has not yet solved the problems of information selection. In cases where the problems are well-defined, it is meaningful to evaluate proposals for the acquisition of a small, marginal amount of information. In the big problems, such as major changes in communication systems, the causal sequences are not known. The evaluation techniques are unable to cope with the problem of acquiring the large amount of information to complement the existing small amount available to the planners. Secondly, the efficiency of the planning process cannot be separated from the informational efficiency of the system as a whole. Concentration of effort on the information inputs and outputs of the planner can yield a fragmented view and consequent sub-optimization.

These considerations arise in Killick's review of the possibilities of development planning. It is Killick's judgment that "planning has generally failed to bring many of the benefits expected of it" (pp. 162-3). He appears to endorse Healey's remark that the planning experience has been "sadly disillusioning for those who believed that planning was the only way" (Healey 1972, p. 761). While the disillusionment appears universal, there have been some success stories and some more general benefits.

The sources of poor plan performance are:

Deficiencies in the plans: they tend to be overambitious, to be based upon inappropriately specified macro-models, to be insufficiently specific about policies and projects, to overlook important non-economic considerations, to fail to incorporate adequate administrative provision for their own implementation.

Inadequate resources: incomplete and unreliable data; too few economists and other planning personnel.

Unanticipated dislocations to domestic economic activity: adverse movements in the terms of trade; irregular flows of development aid; unplanned changes in the private sector.

Institutional weaknesses: failures to locate the planning agency appropriately in the machinery of government; failures of communication between planners, administrators, and their political masters; the importation of institutional arrangements unsuited to local circumstances.

Failings on the part of the administrative civil service: cumbersome bureaucratic procedures; excessive caution and resistance to innovations; personal and departmental rivalries; lack of concern with economic considerations. (Finance Ministries are a particularly frequent target, often said to undermine the planning agency by resisting the coordination of plans and budgets) (Killick, p. 164).

Despite all those problems the economist has tended to rely upon a rationality model: good information, clearly defined objectives, a long view of the future. Killick, in the wider context of his remark quoted in the previous chapter, explores some aspects of uncertainty.

Governments will, moreover, often be right in deferring action in the real world of imperfect knowledge and large uncertainties, especially in open economies highly susceptible to movements in trade and capital flows beyond their own control. Thus Rawls has proposed a 'principle of postponement' which holds that, 'other things being equal, rational plans try to keep our hands free until we have a clear view of the relevant facts' (Rawls, 1971, p. 420). Certainly, one generalization which can be offered with confidence is that knowledge will be very incomplete, the more so the further ahead the decision-maker is trying to look. The existing stock of knowledge, the current flow of information, the capacity to absorb and interpret information--all these are gravely deficient in developing, and all other, countries. Economists are well aware of this but have failed to recognize its uncomfortable implications for development planning. In a hit-or-miss world where there is only the most approximate grasp of how an economy will respond to a given policy action and when that action will almost certainly generate unexpected second-order effects, it is by no means obvious that medium-term planning is helpful or fitting. The standard answer would be that

the remedy is to improve our knowledge rather than abandon planning, but are we entitled to assume that the benefits from acquiring the necessary additional knowledge (even if that were feasible) would exceed the costs of doing so? The recent growth of interest in the economics of information has not yet had much impact on the planning literature. [T]here is little treatment in it of the often acute time constraints within which government decision-makers normally operate and the large costs, therefore, of decision procedures which fail to economize on time. What is clear is that the often acute state of uncertainty in which policy has to be formulated will tend to shorten time horizons in a manner inimical to medium-term planning. (pp. 173-4).

What are the consequences for development planning in general and communication planning in particular? The consequences may be profound. In a fundamental way the role of information is such that it can be argued that planning is impossible. Shackle's reasoning underlines this view.

Information is necessarily about fragments of the cosmos and of history. There is and can be nothing in terms of which an all-encompassing account of the cosmos as a whole through time and space can be given, save perhaps mathematics, and this would not be information but a pure formal creation of thought. At any time a man has some collection of pieces of information fitted into various systems of thought or accepted stereotypes of experience. He cannot know, except in regard to the most immediate physical effects, whether his information is all that exists which bears on his choice of action. If there are gaps, the filling of these gaps with one set of suppositions or another set by inventive thought can radically affect the implications of even his well-founded information. He must select among contrary suggestions. It will be difficult to find a clear meaning in any process of summing or averaging the discordant voices (Shackle 1974, p. 10).

About the same time in 1945 that Arthur Clarke was writing about the future of satellites, an economist, Friedrich August von Hayek, was writing a paper on "The Use of Knowledge by Society." He spoke again on this theme in his 1974 Nobel Memorial Lecture under the title, "The Pretence of Knowledge." On that occasion he argued:

If man is not to do more harm than good in his efforts to improve the social order, he will have to learn that in this, as in all other fields where essential complexity of an organized kind prevails, he cannot acquire the full knowledge which would make mastery of the events possible. He will therefore have to use what knowledge he can achieve, not to shape the results as the craftsman shapes his handiwork, but rather to cultivate a growth by providing the appropriate environment, in the manner in which the gardener does this for his plants. There is danger in the exuberant feeling of ever growing power which the advance of the physical sciences has engendered and which tempts man to try, "dizzy with success", to use a characteristic phrase of early communism, to subject not only our natural but also our human environment to the control of human will. The recognition of the insuperable limits to his knowledge ought indeed to teach the student of society a lesson of humility which should guard him against becoming an accomplice in men's fatal striving to control society--a striving which makes him not only a tyrant over his fellows, but which may well make him the destroyer of a civilization which no brain has designed but which has grown from the free efforts of millions of individuals (p. 442).

This does not mean that the social sciences should not strive for the fullest possible knowledge. Planning requires the substitution of adaptive, evolutionary models for the impracticable, optimization models of problems that are not well-defined. Fuzzy sets are the order of the day. It is no doubt for this reason that the economist's approach to development planning has not been more fruitful. It is perhaps also for this reason that the political process works as well as it does. Killick points to the similarity of a cybernetic approach with its sensitivity to feedback and 'muddling through' (p. 178). For communication planning in particular, the question is again: What constitutes the fullest possible knowledge? The 'richer analysis' of the role of communication is lacking. Knowledge of these processes is fragmentary. There is, therefore, a great deal of scope in extending this kind of knowledge in two ways: first, knowledge of component activities, and secondly, knowledge of the ways in which those component activities are interrelated. Furthermore, if the political economy view expressed above is justified, economic analysis of communication processes must be complemented by analysis of the role of communication in political processes.

CHAPTER 8: COMMUNICATION IN DEVELOPMENT

It was implied in the previous chapter that knowledge of the economic aspects of the role of communication in development is fragmentary. Time has not permitted a complete survey.* Consequently, this chapter focusses on some aspects only.

STOLPER

Stolper's account of the Nigerian experience contains some discussion of the role of communication, or more specifically telecommunications. The Federal Government's "exclusive jurisdiction in all telecommunications" is viewed as contributing to the strong "forces making for increasing national coherence" (p. 32).

The Nigerian telephone system is used to illustrate the problems of capital vs. labor-intensive development strategy. The system was described as "highly capital intensive" (p. 153) and would, therefore, not have been favored in a labor-intensive strategy. Stolper has several important observations on this situation:

The accounting and managerial practices were such that the financial resources generated by the system flowed into the general governmental pool "from which they are reallocated in a manner which may or may not lead to increased savings but which certainly has nothing to do with the fact that the telephone system is capital-intensive" (p. 153).

"One cannot really know whether a particular line of production is or is not relatively capital-intensive until one has worked through an input-output matrix which gives information not only on inter-industry flows but also on the factor inputs of various industries" (p. 156).

To these observations might be added questions of complementarity and adjustments. The capital intensity will depend upon the scope of the definition of the communications sector. If it is confined to an automatic telephone exchange, the conclusion will be highly capital intensive. If, however, the net is cast wider to include activities that precede and follow the transmission of a message, the conclusion is not as obvious. In so far as capital investment creates a new facility and its availability initiates learning and change, early assessments may well differ from those a few years later when adjustment and extended utilization has taken place.

GIMPELSON

Gimpelson's paper emphasizes the higher growth rates of communication systems in many developing countries. Choice of technology is seen as a function of the rate of growth.

Certainly those countries which have embarked upon expansion programs which will rapidly reduce their existing facilities to a minor percentage of the total network investment are justified in introducing semi-electronic exchanges. Slower growth cases require careful economic studies. And for all developing countries the aura of fully electronic systems should be tested against economic realities. At present, there is no answer to the general question of which network and equipment characteristics tend to accommo-

* A valuable bibliography is provided in Rahim (1976).

date technological advances particularly well. It is certain that the rapid pace of technology will no longer permit economical retirement of communications equipment prior to major environmental changes; instead equipment must accommodate the new technology. Technological forecasting and techniques to assure technological flexibility are now the areas most requiring substantial new research (Gimpelson, p. 18).

MADDOX

Maddox adds a significant qualification to Gimpelson's basic proposition.

Communications technology presents a particularly tantalizing dilemma for developing countries. On the one hand, there seems to be a positive advantage in coming in at the eleventh hour. The new communications technology is lighter, more flexible and cheaper than the old. A country can think of installing the very latest in electronic telephone exchanges, inter-city microwave links and satellite stations because they are not hampered by the need to make everything that is new compatible with a great mass of less efficient, existing equipment. (It is the clumsy old Strowger telephone switching which is making the Post Office's task of modernizing the British telephone system so expensive and--to the user so often imperceptible.)

Unfortunately, the hope that any country could make a fresh start in communications has turned out to be an illusion. Since the beginning--that is in 1849 when Austria and Prussia signed a treaty linking their telegraph lines--international communications have been controlled by the richest and most powerful countries. They have dominated the organizations that control and regulate the use and costs of international communications so that the developing world, even when it purchases its expensive new equipment, feels that its special needs and points of view are not adequately represented (Maddox, p. 61).

Maddox argues her thesis in relation to both Intelsat and the International Telecommunications Union.

COOPER

Cooper (1974) distinguishes two distinct parts to the role that communication plays in the development process.

First, there is the informing of world public opinion in a general way about development and the need for financial and technical assistance to promote it; second, communication with those people at regional and village level whose daily lives will be affected by the implementation of development schemes. The first has been variously called 'Mobilization of Public Opinion', 'Influencing Public Attitudes', and 'Public Information on Development'. The second has been referred to as 'Information on Development Planning', and 'Project Support Communication' (Cooper, p. 4a).

Cooper rightly stresses that the communicators should "use descriptions which everyone of them understands" (p. 49). This leads to his practical suggestion "that the descriptions in current use by the United Nations should be accepted internationally: general public information about development to be referred to as 'Mobilization of Public Opinion' and information designed to involve people at local level in development schemes to be called 'Project Support Communication'" (p. 49).

The fragmented view is apparent here. These two types of information flow are by no means all inclusive. In fact, they are largely restricted to the implementation phase. Community input to the policy formation process and a variety of feedbacks could be added. Evaluation of the efficiency of such a system needs to be envisaged in the context of an information input-output matrix. This leads on to consideration of what were called in an earlier chapter the political economy aspects of the planning process.

TICHENOR ET AL., GOLDING, AND ROGERS

Tichenor *et al.* (1970), Golding (1974), and Rogers (1976) do not fall within the literature of the economics of development. They are mentioned here to illustrate enquiry and discussion that must be seen as relevant to economic analysis and model building. As should be apparent by now the economists have implicitly assumed that decision-makers are well-informed and the cost of achieving that state of mind can be ignored. These studies should have a salutary effect on this mode of thought. The Tichenor study brings out the importance of information processing capacity and has considerable economic significance both in efficiency and equity terms. Golding shows the extent to which "stereotyped ideas left over from colonial days are still alive in prevalent theories of Third-

World modernization and development" (p. 39). Rogers has brought together a highly pertinent collection of papers. One general thesis merits reflection: "The newer conceptions of development imply a different and, generally, a wider role for communication" (p. 8).

KHIN MAUNG KYI AND ASSOCIATES

This study examines aspects of communication and development in two Burmese villages. The role of communication as a primary agent of change is accepted (p. 56). The objectives were first "to unearth the existing patterns of communication and secondly to appraise the adequacy or effectiveness of the existing arrangements in facilitating the change process" (p. 57). The village circumstances constitute a 'low-productivity trap'. Planned educational progress is "an important ray of light" (p. 72). Nevertheless, serious difficulties remain.

Though we grant that modern mass media is considered as a spear-head of the modernizing process, its effectiveness could not be fully realized without the support of face-to-face social relationships as well as local social organizations at the village level. The existence of such an organization or relationship which could act as a medium of communication between the planners or promoters of social change living in towns on one hand and the common villagers facing and struggling with problems on the other, is fundamental to the acceleration of technical diffusion and change, or the effectiveness of mass media and the success of other dissemination of new technology in rural areas. Only through constant interaction with villages, could any change be effectively initiated. At present, we have observed that contacts between local officials and the village community is rather perfunctory and sporadic, the results having been shown in responses to our interviews. Direct face-to-face relations between promoters of change--at present, local development officials--and the villagers have never been effectively established. Even the mediation of change through the village leadership is a doubtful proposition when we realize that rift and factionalism are still rampant in the villages, and a social fabric weaving all villagers together beyond the family is found wanting in these communities. The passing away of traditional authority such as local monks and elders is lamentable. Instead, there emerges a new breed of leadership, younger, more well-informed, and more energetic, challenging along with the apathy and individualism of villagers, and the lack of social organization lessen the effectiveness of the new leadership. In many ways the gap between the new leadership and the common villagers is just as wide as that between urbanized officials and villagers. Their style of language, sophistication and their urban orientations probably make them stand apart from the rest of the community. They are probably as isolated from the community they were to lead as the urbanized are from rural dwellers.

Our study of the effectiveness of various mass media throws further light on the problems of diffusion and change. In spite of a great promise of the radio as an instigator of change in rural communities, the performance of the radio as a mass medium does not seem to warrant any self-complacency. The radio programming as it exists now is more urban biased and urban-directed than anything that could effectively promote change in rural communities. It is satisfying to find a significant association between newspaper readership, another mass medium, and the level of information. Yet our interpretation about this finding must be qualified to a large degree when we realize that newspaper reading is still very much restricted in the villages (Kyi, p. 73).

SHAPIRO AND MULLER

Shapiro and Muller (1974) report on the roles of modernization and information among cotton farmers in Tanzania.

A major goal of agricultural policy in many developing nations is the improvement of farm management. Economists have treated aspects of this issue in the literature on technical and allocative efficiency, but much of the work has focused almost entirely on devising techniques for quantifying efficiency differentials. This paper takes the methodological step and attempts to identify sources of such differentials. A simple model is presented relating technical efficiency to general modernization and agricultural information. All three variables are measured among a sample of cotton farmers in Tanzania. Correlation analysis and estimates of modified Cobb-Douglas production functions seem to indicate that general modernization is the more important stress factor and that its impact is primarily labor-augmenting.

The note appended to this paper demonstrates that when management is omitted from a Cobb-Douglas production function the direction of bias in estimated returns to scale depends on the manner in which management enters the "true" function. Griliches' (1957) seminal article on this topic implicitly assumes a particular specification that leads to negative bias, whereas alternate, perhaps more appealing, specifications may yield opposite results (Shapiro and Muller, abstract).

JÉQUIER

Nicholas Jéquier (1976) discusses the hardware vs. software aspects of alternative technology. The software--knowledge, know-how, experience, education, organizational forms--is as important as the new types of machinery. In the developing countries "What is really lacking is the software and this is perhaps the area where the appropriate technology movement has the most to contribute" (p. 22). Jéquier supports this thesis with several examples. The agricultural extension system of 19th century North America and Europe required major adaptation. Success is illustrated by the efforts of the Institut africain pour le développement économique et social (INADES) and the Panafrican Institute for Development. A further example is the modification of Western-style educational systems. Jéquier cites the educational games developed in some African countries (Eco Niger in the Republic of Niger and the Agricultor in the Central Africa Republic), the integration of artisanal activities in the curriculum of the primary schools in Chad, and the emphasis placed on the traditional knowledge of the community in which the school is located. He believes that "Many other similar examples could be found throughout the developing world. Some of them may seem trivial, but development is a process which consists for a large part in thousands of small improvements and modifications in software, rather than in sudden and massive leaps forward in hardware. Software however lacks visibility, and often tends for this reason to be overlooked, not only by national planners and policy makers, but also by many of the small-scale organizations now active in the field of appropriate technology" (p. 23).

NELSON

Nelson (1974) takes economists to task because they have been prone "to make a sharp conceptual split between routine operation and innovation" (p. 73). In the technology transfer context information flows may prove to be the most important connecting link.

The nine studies reported briefly in this chapter have touched upon various aspects of the role of communication in the development process. They constitute adequate illustration of the need for much more inquiry. While it is to be hoped that such inquiry proceeds, it will be unfortunate if it is a piecemeal matter lacking an appropriate conceptual framework and all too frequently being pushed into the traditional forms of the economist's models.

Initiatives outside economics can be very important. A good illustration is provided in a recent issue of the *Journal of Communication*. Rogers (1978) states his views on new approaches to development; Porat (1978) explores some global implications of the information society; Parker (1978) poses big questions about the potential benefits to the Third World of a human-development information-intensive strategy; and McAnany (1978) challenges the underlying assumptions of communication aid programs with respect to equity, cost, feasibility, and obstacles to change. Perhaps more economists should be devoting their attention to the problems being researched in communication studies.

In Chapter 9 this monograph turns to some elaboration of the information sector approach introduced earlier. Such an approach is a prerequisite for the input-output analyses that Stolper saw as necessary. Even crude input-output data supplemented by physical measures of information flows where possible would constitute a major advance on the existing situation. This need for a conceptual framework is apparent even in the report (Pierce and Jéquier 1977) of the most promising of present attempts to assess the contribution of telecommunications to economic development. This major new study is jointly sponsored by the International Telecommunications Union (ITU) and the Development Centre of the O.E.C.D. It plans close cooperation with national telecommunication administrations, industrial firms, international aid agencies and university research centers. It aims to show that investment in telecommunication facilities have "a number of multiplier effects that go far beyond what is generally assumed" (p. 533). It would appear that the input-output approach, given detailed statistics of the information sector, is indispensable to such analysis.

CHAPTER 9: A NEW APPROACH

Reference has been made earlier to the information sector approach. Porat's work was cited in Chapter 2 to illustrate the application of sectoral analysis to the study of the role of communication or of information processes in the economic system. In Chapter 6 a brief review of developments in the economics of information showed that economists have at long last begun to appreciate the vital role of information in economic systems and subject that role to both theoretical analysis and empirical inquiry. Because the role of knowledge is so fundamental in the process of economic change, it is hoped that the difficulties of reconciling the outcomes of research on developed and developing countries will not prove insuperable. In the course of the effort to record and measure communication/information activities, it will be well to remember the cautions advanced by Streeten (1974) and what is perhaps even more important the doubt of Stiglitz (1974) that information can be treated as just another commodity (cf. Lamberton 1975). As the English economist, Alfred Marshall wrote at the end of last century, "Ideas, whether those of art or science, or those embodied in practical appliances, are the most 'real' of the gifts that each generation receives from its predecessors. The world's material wealth would be replaced quickly if it were destroyed, but the ideas by which it were made retained. If however the ideas were lost, but not the material wealth, then that would dwindle and the world would go back to poverty" (p. 780).

In Chapter 2 the conceptual basis of Porat's sectoral analysis was indicated. Here an attempt will be made to show how that approach was implemented in the study of the U.S. economy and to indicate some of the potential that the approach possesses. Porat uses the following figures a-c to illustrate the flows between his sectors. Figure 1 (Porat, 1977, p. 17) relates to market transactions. The flow of information goods and services (e.g. computers purchased by business firms in the private bureaucracy; radios purchased by households; and R & D services purchased by governmental agencies in the public bureaucracy) moves from the primary information sector. Noninformation goods and services flow from the private productive sector. Figure 2 (Porat, 1977, p. 18) shows the non-market information flows while Figure 3 (Porat, 1977, p. 19) divides the flow of labor from the household sector into information workers and noninformation workers.

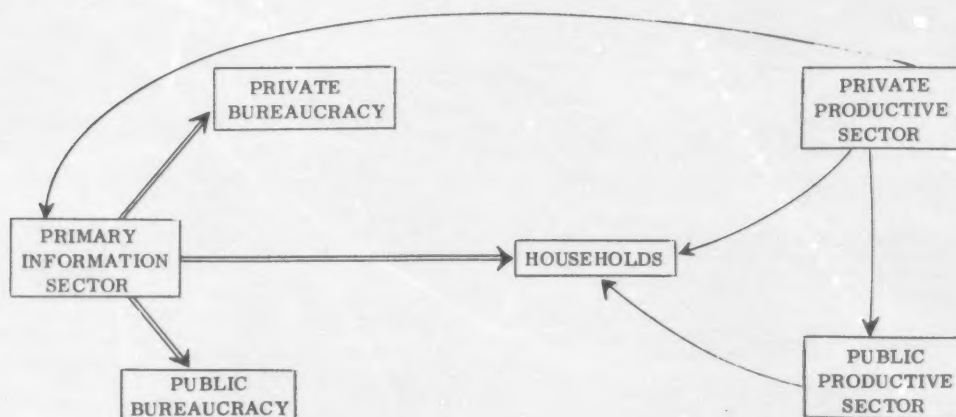


Figure 1. Flow of Goods and Services (Market Transactions)

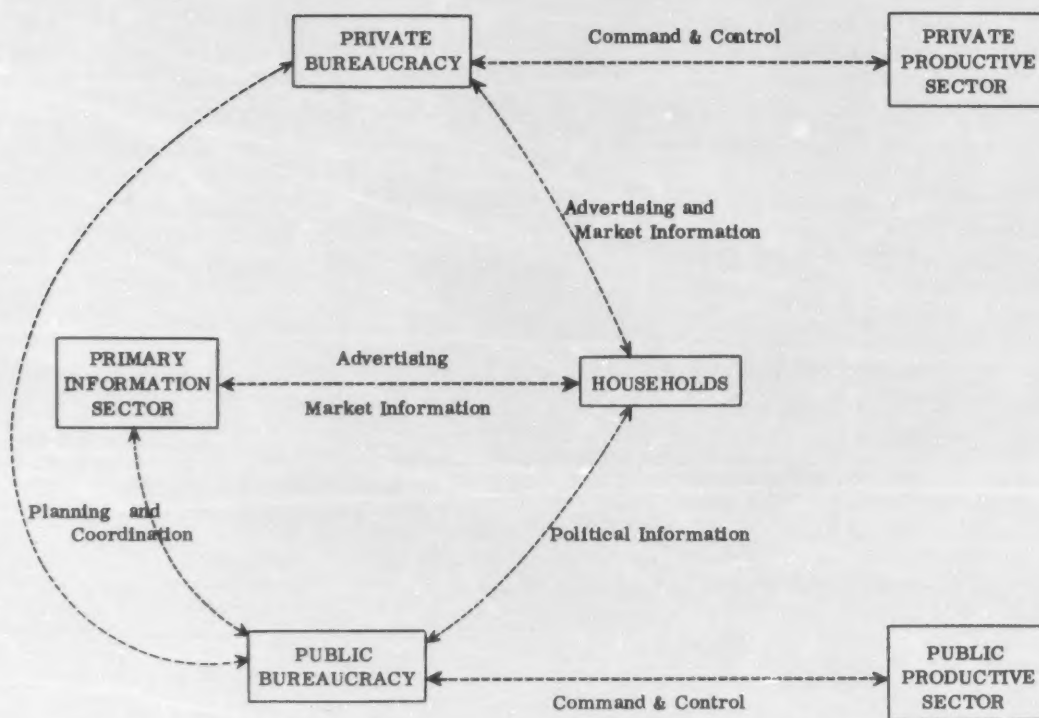


Figure 2. Flow of Information (Non-market)

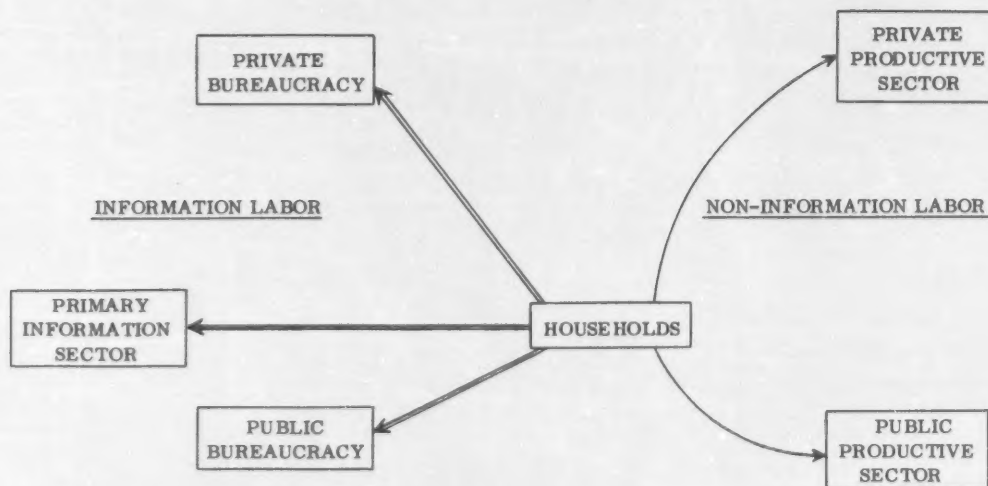


Figure 3. Flow of Labor (and Income)

Appendix B1 shows what Porat calls (pp. 27-28) a "detailed typology" of the primary information sector. With the accounting work carried out it becomes possible to indicate:

- How many cents of every consumer dollar was spent on information goods and services.
- How many cents of every dollar invested was for information machines and buildings.
- What did the primary information sector contribute to the net trade balance.
- What proportion of durable goods were information machines and equipment.
- What proportion of structures were information buildings such as libraries, schools, and telephone facilities.
- What proportion of corporate profits originate in the primary information sector.
- What proportion of added value originated in the primary information sector for all industries and individual industries.

In similar fashion the statistical analysis of the secondary sector was carried out. Here again, for example, the proportion of value added in the private and public bureaucracies, for all industries and each individual industry, was ascertained (Porat 1977, Chs. 8-9).

This brief report cannot do justice to Porat's highly significant study. It is intended merely to illustrate the mode of analysis. Given the conceptual framework, the structural relationships and their evolution over time--Porat provides time series for the period 1929-1974--can be studied. Input-output techniques can be applied. The results of the richer analyses that have been advocated can be placed in a general context. For example, such data could be manipulated to study alternative models of the communication process and permit comparative studies between countries. A further point is that such a framework is a prerequisite for the cost-benefit analysis of communication projects.

If the equality issue is deemed important, the effects of communication policies on income distribution must be examined. There seems to be reason to think that the role of education has been a too narrow focus for exploration of the effects of growth on inequality (cf. Blaug; O. E. C. D.; and Starrett. The focus must be shifted to the individual's information processing capacity. Research in this area will be facilitated by the information sector approach.

Other major issues can be identified. Porat suggests: the information infrastructure; imperfect information and market structure; centralization and decentralization; the property paradigm and information; and informational and international trade. The growth of the information economy as an inflationary influence has been added by Parker (1976, p. 89).

CHAPTER 10: CONCLUSION

While the potential of the new approach is great, the difficulties and costs should not be underestimated. The major unsettled question concerns sectoral identity. Kuznets long ago warned that in the study of economic growth the unit must "not be vague, too small, or too large for the purpose" (Kuznets 1951, p. 27). Each of these charges has been laid against the information sector concept as it is currently developing. The set of problems ranges from narrow, highly specific aspects such as the apportionment of a television set between decorative and informative functions to locating the broad boundary between the information and industrial sectors and impinges on the highly important analytical question of what kinds of information processes are most significant in a development or change context.

Taking up the sectoral identity question first, it seemed useful to return to Kuznets' early work to see what he had to say on the problem. The following extract from his Economic Growth of Nations by no means disposes of the issue.

The problem of sectoral identity can be illustrated by asking whether, when we compare the shares of the agricultural sector of a developed country in the 1840s and in the 1960s, we are dealing with one and the same sector. Is such an approach realistic for agriculture in, say, the United States--first, in view of the vast differences in technology of operation and in the extent of dependence on other sectors (for such items as machinery, chemical fertilizers, or hybrid seeds); and second, in view of the marked differences in degree of specialization and the shift from the self-sufficient rural population of the early nineteenth century, capable of producing a variety of nonagricultural goods, to the specialized farmers of today? Likewise, when we compare the shares of the agricultural sector in the developed countries with those in the much less developed countries of Asia or SubSaharan Africa, is it realistic to treat them as one and the same sector, in view, again, of the vast differences in technology and degree of specialization? The same question arises in regard to manufacturing, which ranges from huge, large-scale, capital-endowed factories to home handicraft units; and to services, which range from highly skilled professional performance to unskilled menial work.

These questions may be answered by pointing out that agriculture supplies the essential foods for human consumption: it does so today in both developed and less developed countries, and it did in the early nineteenth century; that agriculture is tied to the soil, and is a relatively small-scale activity imposing a pattern of life on its participants that is different from the more concentrated urban pursuits--today in both developed and less developed countries, and in the former in the early nineteenth century. To the extent that this is true, agriculture does constitute a sector in regard to which developed and less developed countries and the developed countries today and in the nineteenth century can be compared. The same argument holds for manufacturing, or construction, or transport, or trade, or services. In this sense a clear identification of the sectors prevails despite marked differences in technology and specialization.

But it is also true that our classification, which fails to distinguish between traditional agriculture and modern agriculture, between handicraft manufacturing and animal transport, on the one hand, and modern manufacturing and mechanical transport, on the other, does understate, for that reason, the change in production structure associated with modern economic growth; it conceals much of the international disparity in production structure between the developed and less developed countries. A crude adjustment can occasionally be made for effects of differences in specialization. For example, in the treatment of a productive factor like labor it is possible to distinguish between fully employed wage and salary labor and unpaid family labor; and, of course, some of the differences emerge in comparisons of product per worker for one and the same sector--over time or across space. But the classification of productive sectors is

particularly weak in indicating the extent of uses of technology, as contrasted with major differences in the nature of the product and of broad conditions of production. It is, therefore, important to remember that measures of the change in sectoral shares that accompanies modern economic growth understate-- by a large margin--long-term changes in production structure and international differences in such structure between developed and less developed countries (Kuznets 1971, pp. 100-102).

The ongoing process of structural change and very limited ability to predict its pattern undermine the analytical effort. Nevertheless, analysis is sought and is needed for policy purposes. There seems little to suggest that the agricultural sector is a sounder concept than the information sector. Should the latter prove in some way more ephemeral, this may tell more about the speed of technological change than failure of information sector analysis.

The second aspect of sectoral identity raised earlier was the relationship of the sector to any scheme for categorizing information flows. Traditional national accounting has used the notion of an intermediate good. In the case of ore that is mined, refined, and used in the production of steel the notion is clear enough. However, when expenditures are needed to secure workforce participation and the smooth operation of the production system, the element of judgment is increased and the problems multiply. Consider, for example, the costs of industrial relations disputes as structural change occurs, the costs of the legal system as it responds to requirements on environmental matters, or the costs of supranational organizations, both private and governmental, as international interdependence increases. In each of these cases the costs are largely information costs and the treatment of the items as intermediate would have a bearing upon the measure of economic growth.

In similar fashion the traditional dichotomy between capital formation and consumption can be applied to information sectors components. Many information activities can be regarded as creating a future stream of income. R & D, for example, has been viewed in this manner.

National accounting has not yet responded adequately to these challenges (cf. Hibbert and Walton in Perlman 1977). The attitude seems to be: Leave the national accounts alone and develop special purpose systems. And yet one wonders whether this is the right approach. After all, the strength of the national accounting system was in its consistency and the interconnectedness of its parts. Does fragmentation now seem to have advantages? It may prove that the national accountants are clinging to an outmoded taxonomy. If, for example, Klein's suggestive notion of a relationship between randomness of communications and creativeness of R & D activity were strongly supported by further studies, is there any way in which the relationship could be subjected to study within the framework of existing national accounting and input-output methodologies? Important new questions are looming and new responses are called for. For example, Elkana *et al.* (1978) initiate a major new discussion of the potential development of science indicators. These comments can only touch on some aspects of the emerging social requirements generated by the information revolution.

This monograph has reviewed a wide range of writing and research relating to the economics of communication. It has brought out the inadequacies of static models and of fragmented viewpoints and the failure to identify information processing as a fundamental feature of the economic system. These were not new criticisms. However, a new approach is now available and would seem to offer a partial solution. Information sector analysis may combine with evolutionary economic models and the adaptive planning approach.

As mentioned earlier, the O.E.C.D. has taken an initiative in this matter and a comparative information sector study of at least some O.E.C.D. countries will be carried out. It is a matter of urgency that similar efforts be initiated in relation to developing economies. Without doubt the attempt to apply information sector analysis to the developing countries will quickly reveal both major structural differences and problems stemming from the American or Western experience and values that have shaped that analysis. The defense of the proposal must at this stage be the importance of communication/information in the development process and its pervasive nature. Economics in the information society must be on economics of information. Economics in any society must not neglect the economics of information.

APPENDIX A

APPENDIX A

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Founded by David Davidson in 1899

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THE ORGANIZATION AND RETRIEVAL OF ECONOMIC KNOWLEDGE

Proceedings of a Conference held by the International Economic Association at Kiel,
West Germany

Edited by Mark Perlman, Professor of Economics, University of Pittsburgh

The physical and the cost problems of organizing and then retrieving economics material has long worried the economic and library professions; now with the "information explosion revolution", the problem has assumed imminently-approaching disaster proportions. In 1975 a conference on these problems was held in Kiel, West Germany, where 26 papers, prepared by economists, data retrieval specialists, and librarians were presented and discussed. Each paper is preceded by a brief abstract and is followed by a summary record of the ensuing debate and discussion.

Contents: Part One: The Technology of the Library Industry and its Use for Economic Research--The Use of Libraries by Economists: A Personal View; Charles Kindleberger--Computerised Approaches to the Literature of Economics: From ISIS to DEVSIS; George K. Thompson--National Economic Information Systems for Developed Countries; Otto Eckstein--The Organization of Quantitative Data in Brazil; Lulz Carlos, A. C. Olinto and Isaac Kerstenetzky--Part Two: The Economics of the Economics Library Industry and its Implications--The Effectiveness of Secondary Information Systems in Economics and Industry; Jack N. Wolfe--The High Cost of Information and Some Approaches to its Acquisition; John J. Fetterman--Interlocking Catalogues; Erwin Heidemann--Organizing an Inter-library Network: The State University of New York Approach; Glyn T. Evans--Economics of Computerized Library Networks; Frederick G. Kilgour--The Changing Modes of Data in Recent Research; Naomi and Mark Perlman--Part Three: The Information Needs of Researchers and their Implications for the Library Industry: Developments in National Accounts; Jack Hibbert and John Walton--The Usefulness of Microdata and Some Strategies for Storing, Using, and Disposing of It; James N. Morgan--Library Policies for Research in Monetary Economics; Anna J. Schwartz--Development of Fiscal Economics During the Decade, 1975-1985; Carl S. Shoup--Information Needs in Regional Economics; Edwin von Boventer--Information Needs and Data Requirements for International Economic Research; William G. Tyler--Data Needs in Development Economics; Carlos F. Diaz-Alejandro--Information Needs for Agricultural Development, Policy and Planning; Montague Yudelman--Competition versus Planned Specialization in the Development of Resources for Research in Industrial Organization; Michael Gort--Some Information about Technological Progress and Economic Growth; Yu. A. Borko--The Relevance of Recent Trends in Economic History to the Information Needs of Research Workers in the Field; Phyllis Deane--The Information Needs of Economic Researchers in the Field of Comparative Economic Systems; Paul Chamley--Data in the Planned Economy of the USSR; M. S. Palnicov--The History of Economic Thought and Analysis: Organization and Retrieval of Its Content; Joseph J. Spengler--Part Four: The Nature of Economics and Its Implications for the Organization of Economic Knowledge: Economics and Contiguous Disciplines; Ronald H. Coarse--Methodologies of Economics; Harry G. Johnson

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APPENDIX B

1. Detailed Typology of the Primary Information Sector

Source: Porat, 1977, pp. 27-28.

2. The U.S. Information Economy

Table 1	Gross National Product, 1967.
Table 2	Gross National Product by Major Type of Product and Purchaser, 1967.
Table 3	National Income by Type of Income, 1967.
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Table 5	Gross National Product of the Secondary Information Sector, 1967.
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Table 7	Gross Product Originating by Industry in the Secondary Information Sector, 1967.

Source: Porat, 1977.

TABLE 3.2: DETAILED TYPOLOGY OF THE PRIMARY INFORMATION SECTOR

<u>MARKETS FOR INFORMATION</u>	
<u>KNOWLEDGE PRODUCTION AND INVENTIVE INDUSTRIES</u>	
<u>R&D and Inventive Industries</u>	
(7391)	Commercial Research and Development Laboratories
(7397)	Commercial Testing Laboratories
(8921)	Nonprofit Education and Scientific Research Agencies
<u>Private Information Services</u>	
(6281)	Services Allied with the Exchange of Securities or Commodities
(6611)	Combinations of Real Estate, Insurance, Loans, Law Offices
(7392)	Business, Management, Administrative, and Consulting Services
(8111)	Legal Services
(8911)	Engineering and Architectural Services
(8931)	Accounting, Auditing, and Bookkeeping Services
(8999)	Services, Not Elsewhere Classified
<u>INFORMATION DISTRIBUTION AND COMMUNICATION INDUSTRIES</u>	
<u>Education</u>	
(8211)	Elementary and Secondary Schools
(8221)	Colleges, Universities, and Professional Schools
(8222)	Junior Colleges and Technical Institutes
(8241)	Correspondence Schools
(8242)	Vocational Schools, Except Vocational High Schools
(8299)	Schools and Educational Services, Not Elsewhere Classified
<u>Public Information Services</u>	
(8231)	Libraries and Information Centers
<u>Regulated Communication Media</u>	
(4832)	Radio Broadcasting
(4833)	Television Broadcasting
<u>Unregulated Communication Media</u>	
(2711)	Newspapers: Publishing, Publishing and Printing
(2721)	Periodicals: Publishing, Publishing and Printing
(2731)	Books: Publishing, Publishing and Printing
(2741)	Miscellaneous Publishing
(7351)	News Syndicates
(7813)	Motion Picture Production, Except for Television
(7814)	Motion Picture and Tape Production for Television
(7815)	Production of Still and Slide Films
(7816)	Motion Picture Film Exchange
(7817)	Film or Tape Distribution for Television
(7821)	Motion Picture Service Industries
(7922)	Theatrical Producers (Except Motion Picture) and Miscellaneous Theatrical Services

<u>INFORMATION IN MARKETS</u>	
<u>SEARCH AND COORDINATION INDUSTRIES</u>	
<u>Search and Non-Speculative Brokerage Industries</u>	
(6052)	Foreign Exchange Establishments
(6053)	Check Cashing Agencies and Currency Exchanges
(6055)	Clearing House Associations
(6161)	Loan Correspondents and Brokers
(6231)	Security and Commodity Exchanges
(6411)	Insurance Agents, Brokers, and Service
(6531)	Agents, Brokers, and Managers
(6541)	Title Abstract Companies
(7313)	Radio, Television, and Publishers' Advertising Representatives
(7321)	Consumer Credit Reporting Agencies, Mercantile Reporting Agencies, and Adjustments and Collection Agencies
(7361)	Private Employment Agencies
(7398)	Temporary Help Supply Services
(7818)	Services Allied to Motion Picture Distribution
<u>Advertising Industries</u>	
(3993)	Signs and Advertising Displays
(7311)	Advertising Agencies
(7312)	Outdoor Advertising Services
(7319)	Miscellaneous Advertising
(7331)	Direct Mail Advertising Services
<u>Non-Market Coordinating Institutions</u>	
(8611)	Business Associations
(8621)	Professional Membership Organizations
(8631)	Labor Unions and Similar Labor Organizations
(8651)	Political Organizations
<u>RISK MANAGEMENT INDUSTRIES</u>	
<u>Insurance Industries (Components Only)</u>	
(63)	Life, Accident, Fire and Casualty
(636)	Title Insurance
<u>Finance Industries (Components Only)</u>	
(60)	Commercial, Savings Banks & Related Institutions
(61)	Credit Institutions
<u>Speculative Brokers (Components Only)</u>	
(62)	Security Brokers, Commodity Contractors
(63)	Patent Owners and Lessors

INFORMATION INFRASTRUCTUREINFORMATION PROCESSING AND TRANSMISSION SERVICESNon-Electronic Based ProcessingFixed Costs:

- (2753) Engraving and Plate Printing
- (2791) Typesetting
- (2793) Photoengraving
- (2794) Electrotyping and Stereotyping

Variable Costs:

- (2732) Book Printing
- (2751) Commercial Printing, Except Lithographic
- (2752) Commercial Printing, Lithographic
- (2789) Bookbinding and Related Work
- (7221) Photographic Studios, Including Commercial Photography
- (7332) Blueprinting and Photocopying Services
- (7339) Stenographic Services; and Duplicating Services, Not Elsewhere Classified
- (7395) Photofinishing Laboratories

Electronic Based Processing

- (7392) Pure Data Processing Services

Telecommunication Infrastructure

- (4811) Telephone Communication (Wire or Radio)
- (4821) Telegraph Communication (Wire or Radio)
- (4899) Communication Services, Not Elsewhere Classified

INFORMATION GOODS MANUFACTURING INDUSTRIESNon-Electronic Consumption or Intermediate Goods

- (2621) Paper Mills, Except Building Paper Mills
- (2642) Envelopes
- (2761) Manifold Business Forms
- (2782) Blankbooks, Loose Leaf Binders and Devices
- (2893) Printing Ink
- (2895) Carbon Black
- (3861) Photographic Equipment and Supplies
- (3951) Pens, Pen Points, Fountain Pens, Ball Point Pens, Mechanical Pencils and Parts
- (3952) Lead Pencils, Crayons, and Artists' Materials
- (3953) Marking Devices
- (3955) Carbon Paper and Ink Ribbons

Non-Electronic Investment Goods

- (3554) Paper Industries Machinery
- (3555) Printing Trades Machinery and Equipment
- (3574) Calculating and Accounting Machines, Except Electronic Computing Equipment
- (3576) Scales and Balances, Except Laboratory
- (3579) Office Machines, Not Elsewhere Classified
- (3821) Mechanical Measuring and Controlling Instruments, Except Automatic Temperature Controls
- (3822) Automatic Temperature Controls
- (3821) Optical Instruments and Lenses

Electronic Consumption or Intermediate Goods

- (3652) Phonograph Records
- (3671) Radio and Television Receiving Type Electron Tubes, Except Cathode Ray
- (3672) Cathode Ray Picture Tubes
- (3673) Transmitting, Industrial and Special Purpose Electron Tubes
- (3674) Semiconductors and Related Devices
- (3679) Electronic Components and Accessories, Not Elsewhere Classified
- (5065) Electronic Parts and Equipment

Electronic Investment Goods

- (3573) Electronic Computing Equipment
- (3611) Electric Measuring Instruments and Test Equipment
- (3651) Radio and Television Receiving Sets, Except Communication Types
- (3661) Telephone and Telegraph Apparatus
- (3662) Radio and Television Transmitting, Signalling, and Detection Equipment and Apparatus
- (3693) Radiographic X-ray, Fluoroscopic X-ray, Therapeutic X-ray, and other X-ray Apparatus and Tubes; Electromedical and Electrotherapeutic Apparatus
- (3811) Engineering, Laboratory, and Scientific and Research Instruments and Associated Equipment

WHOLESALE AND RETAIL TRADE IN INFORMATION GOODSHousehold Investment Goods

- (5732) Radio and Television Stores
- (5996) Camera and Photographic Supply Stores
- Hand Calculators

Consumption Goods

- (5942) Book Stores
- (5994) News Dealers and Newsstands
- (7832) Motion Picture Theaters, Except Drive-in
- (7833) Drive-in Motion Picture Theaters

SUPPORT FACILITIES FOR INFORMATIONAL ACTIVITIES

- (15) Contract Construction of Office, School, Communications Buildings
- (65) Rentals of Information Structures
- (25) Furnishings for Office Buildings

TABLE 1: Gross National Product, 1967 (millions of dollars)

	Total final demand	Information final demand	Information percent of total
Gross national product	795,388	174,585	21.9
Personal consumption expenditures	490,358	83,742	17.1
Durable goods	69,646	5,261	7.6
Nondurable goods	212,593	4,006	1.9
Services	208,119	74,485	35.8
Gross private domestic investment	120,829	21,583	17.9
Fixed investment	110,730	19,958	18.0
Structures	57,430	9,871	17.2
Producers durable	53,300	10,087	18.9
Change in business inventories	10,099	1,625	16.1
Net export of goods and services	4,937	2,942	59.6
Government purchases of goods and services	180,188	66,308	36.8
Federal	90,924	26,796	29.5
State and local	89,264	39,512	44.3
Statistical adjustment	-924		

Porat, 1977, p. 50

TABLE 2: Gross National Product by Major Type of Product and Purchaser, 1967

	Total final demand (Billion \$)	Information final demand (Million \$)	Information percent of total
Gross national product	795.4	174,585	21.9
Durable goods	148.7	26,678	17.9
Personal consumption expenditures	69.6	5,261	7.6
Producers durable equipment	53.3	10,087	18.9
Government purchases	16.3	8,848	54.3
Net exports	4.2	1,326	31.6
Change in business inventories	5.3	1,156	21.8
Nondurable goods	238.5	5,392	2.3
Personal consumption expenditures	212.6	4,006	18.8
Government purchases	21.5	1,139	5.3
Net exports	-0.4	-222	-
Change in business inventories	4.8	2,469	9.8
Services	326.2	124,826	38.3
Personal consumption expenditures	208.2	74,485	35.8
Government purchases	116.9	48,503	41.5
Net exports	1.1	1,838	167.0
Structures	82.9	17,689	21.3
Private structures	57.4	9,871	17.2
Government structures	25.5	7,818	30.7
Statistical adjustment	-1.0		

*Includes change in business inventories from service sector.

Porat, 1977, p. 52

TABLE 3: National Income by Type of Income, 1967 (millions of dollars)

	Total national income	Information national income	Information percent of total
National income	655,805	176,319	26.9
Compensation of employees	471,915	136,488	28.9
Private	376,514	99,328	26.4
Military	18,842	4,432	23.5
Government civilian	76,559	32,728	42.7
Proprietors' income	60,974	9,187	15.1
Business and professional	48,894	9,187	18.8
Farm	12,080	0	0
Rental income of persons with capital consumption adjustments ^a	19,376	0	0
Corporate profits and inventory valuation adjustment	79,261	33,675	42.5
Profits	77,330	33,675	43.5
Inventory valuation adjustments	1,744	n.a.	
Capital consumption adjustment	3,675	n.a.	
Net interest	24,279	-3,031	-

n.a. - not available.

^aCapital Consumption Adjustments are adjustments made to depreciation by the Bureau of Economic Analysis, Department of Commerce to reflect current replacement cost.

Porat, 1977, p. 53

TABLE 4: Gross Product Originating by Industry, 1967 (millions of dollars)

	Total value added	Information value added	Information percent of total
All industries, total (GNP)	795,388	200,025	25.1
Agriculture, forestry and fisheries	26,733	0	0
Mining	13,886	0	0
Contract construction	36,102	8,527	23.6
Manufacturing	223,729	32,691	14.6
Nondurable goods	90,595	11,762	13.0
Paper and allied products	8,005	1,539	19.2
Printing and publishing	10,718	10,223	95.4
Other	71,872	0	0
Durable goods	133,134	20,929	15.7
Furniture	3,380	528	15.6
Machinery, excluding electric	23,980	3,198	13.3
Electrical machinery	19,959	12,123	60.7
Instruments	5,606	4,309	76.9
Miscellaneous manufacturing	3,305	771	23.3
Other	76,904	0	0
Transportation	32,040	0	0
Communication	17,632	17,609	(^a)
Telephone and telegraph	16,024	16,029	(^a)
Radio broadcasting and television	1,608	1,580	(^a)
Electric, gas and sanitary services	18,429	0	0
Wholesale and retail trade	129,863	16,053	12.4
Wholesale trade	51,802	8,584	16.6
Retail trade	78,061	7,469	9.6
Finance, insurance, and real estate	108,840	41,425	38.1
Banking	11,843	11,731	(^a)
Credit agencies, holding and other investment companies	-437	-790	
Security and community brokers	3,582	2,779	77.6
Insurance carriers	7,822	8,826	(^a)
Insurance agents, brokers and service	3,344	3,485	(^a)
Real estate	82,686	15,394	18.6
Services	86,992	43,021	49.4
Personal and miscellaneous repair services	9,751	853	8.7
Miscellaneous business services	11,919	10,703	89.8
Motion pictures	1,690	1,525	(^a)
Amusement and recreation services	3,607	485	13.4
Medical and other health services	21,392	5,754	26.9
Miscellaneous professional services	12,738	12,183	95.6
Educational services	5,446	5,170	(^a)
Nonprofit membership organizations	7,527	6,348	84.3
Other	12,922	0	0
Government and government enterprises	95,827	40,699	42.5
Federal	40,559	15,771	38.9
General government	35,865	10,232	28.5
Government enterprises	4,694	3,539	75.4
State and local	55,268	26,928	48.7
General government	49,222	26,928	54.7
Government enterprise	6,046	0	0
Rest of the world	4,510	0	0
Statistical adjustment	802		

(^a) Discrepancy between National Income Accounts and Input-Output Worktape—100% of industry allocated to information.

TABLE 5: Gross National Product of the Secondary Information Sector, 1967

	Total final demand	Secondary information final demand	Information percent of total
Gross national product	795,388	27,440	3.4
Personal consumption expenditures	490,358	0	0
Gross private domestic investment	120,829	0	0
Net exports of goods and services	4,937	1,586	32.1
Royalties	n.e.	1,586	-
Government purchases of goods and services ^a	180,188	25,854	14.3
Federal secondary information purchases	n.e.	14,812	-
State and local secondary information purchases	n.e.	11,042	-
Statistical adjustments	-924	-	-

^aIncludes federal purchases of R&D from non-information industries and employee compensation of information workers in the secondary gov't. information industries. (See chapter 8.)

Porat, 1977, p. 161

TABLE 6: National Income by Type of Income of the Secondary Information Sector

	Total national income	Secondary information national income	Information percent of total
National income	655,805	162,253	24.7
Compensation of employees	471,915	139,405	29.5
Private	376,514	120,670	32.0
Military	18,842	3,348	17.8
Government civilian	76,559	15,387	20.1
Proprietors' income	60,974	22,848	37.5
Business and professional	48,894	22,659	46.3
Farm	12,080	189	1.6
Rental income of persons	19,736	0	0
Corporate profits and inventory valuation adjustments	79,261	0	0
Net interest	24,279	0	0

Porat, 1977, p. 159

TABLE 7: Gross Product Originating by Industry in the Secondary Information Sector, 1967 (millions of dollars)

	Total value added	Secondary information value added ^a	Information percent of total
All industries, total (GNP)	795,388	168,073	21.1
Agriculture, forestry and fisheries	26,733	467	1.7
Mining	13,886	1,512	10.9
Contract construction	36,102	13,243	36.7
Manufacturing	223,729	57,860	25.8
Nondurable goods	90,595	21,044	23.2
Food and kindred products	22,340	5,248	23.5
Tobacco manufacturers	3,490	254	7.3
Textile mill products	6,619	1,373	20.7
Apparel and other fabricated textile products	7,816	2,670	34.2
Paper and allied products	8,005	2,109	26.3
Printing, publishing and allied industries	10,718	565	5.3
Chemicals and allied products	16,687	5,266	31.6
Petroleum refining and related industries	7,050	1,337	19.0
Rubber and miscellaneous plastic products	5,626	1,702	30.3
Leather and leather products	2,244	520	23.2
Durable goods	133,134	36,836	27.7
Lumber and wood products except furniture	4,873	1,069	21.9
Furniture and fixtures	3,380	777	23.0
Stone, clay and glass products	6,597	2,035	30.8
Primary metal industries	18,009	4,350	24.2
Fabricated metal products	14,674	4,681	31.9
Machinery, except electrical	23,980	7,259	30.3
Electrical machinery	19,959	3,273	16.4
Transportation equipment and ordnance exc. motor vehicles	16,417	8,771	53.4
Motor vehicles and equipment	16,334	3,116	19.1
Miscellaneous manufacturing industries	3,305	1,140	34.5
Instruments	5,606	365	6.5
Transportation	32,040	8,115	25.3
Communication	17,632	0	0
Electric, gas and sanitary services	18,429	2,612	14.2
Wholesale and retail trade	129,863	42,447	32.7
Finance, insurance, and real estate	108,840	3,341	3.1
Real estate	82,686	2,764	3.3
Other	26,154	577	2.2
Services	86,992	19,204	22.1
Hotels personal and repair services except auto	14,307	3,740	26.1
Miscellaneous business services	11,919	6,535	54.8
Automobile repair and services	3,889	1,376	35.4
Motion pictures	1,690	0	0
Amusements except motion pictures	3,607	780	21.6
Medical, educational services and nonprofit organizations	34,365	6,773	19.7
Other	17,215	0	0
Government and government enterprises	95,827	18,735	19.6
Federal	40,559	7,693	19.0
General government	35,865	6,357	17.7
Government enterprises	4,694	1,336	28.5
State and local	55,268	11,042	20.0
General government	49,222	9,601	19.5
Government enterprises	6,046	1,441	23.8
Rest of the world	4,510	517	11.5
Statistical adjustment	805	-	-

^aIncludes labor income of information workers and capital consumption allowances on information machines.

Porat, 1977, pp. 158-159

APPENDIX C

APPENDIX C

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APPENDIX C

1. United Kingdom

FOUR SECTOR TIME SERIES OF UK LABOUR FORCE 1841-1971 PERCENTAGES OF 'ECONOMICALLY ACTIVE' POPULATION

TIME SECTOR	1841	1861	1881	1901	1911	1921	1931	1951	1961	1971
Information	4.6	5.6	7.9	12.4	13.3	19.8	20.9	27.8	33.1	36.6
Agriculture	21.6	20.3	12.1	8.2	7.6	7.3	6.4	5.2	3.9	3.0
Industry	44.0	47.2	49.5	45.4	43.4	43.2	45.2	39.9	36.1	33.7
Services	29.8	26.9	30.5	34.0	35.7	29.7	27.5	27.1	26.9	26.7

Source: Wall, 1977.

APPENDIX C

2. Australia

TABLE 1. THE STRUCTURE OF THE AUSTRALIAN WORKFORCE 1911-1971: OCCUPATION APPROACH

SECTOR		1911	1921	1933		1947	1961	1966	1971 ^a
				Total	Excluding Unemployed				
PRIMARY	Total % W. F.	561,777 31.0	551,338 27.0	622,665 23.2	502,823 22.3	522,113 16.5	502,823 12.0	502,333 10.5	475,456 9.1
SECONDARY (Manufacturing)	Total % W. F.	486,769 27.0	566,939 27.5	829,886 30.9	667,465 29.5	1,006,367 33.0	1,369,410 33.0	1,572,955 33.0	1,635,222 31.2
TERTIARY (Service)	Total % W. F.	608,805 33.5	698,071 34.0	813,834 30.3	729,328 32.3	1,118,877 35.0	1,351,145 32.5	1,489,053 31.0	1,684,459 32.2
INFORMATION	Total % W. F.	155,925 8.5	234,458 11.5	419,951 15.6	360,088 15.9	549,074 17.0	949,914 22.5	1,216,521 25.5	1,440,461 27.5
TOTAL WORKFORCE		1,813,276	2,050,806	2,686,336	2,259,704	3,196,431	4,173,292	4,780,862	5,235,598
TOTAL POPULATION		4,455,005	5,435,734	6,629,839	6,629,839	7,579,358	10,508,186	11,550,562	12,755,638
% of POPULATION IN WORKFORCE		40.7	37.7	40.5	34.1	42.2	39.7	41.4	41.0

^aOf 240,706 originally classed as "Occupation Not Stated" in 1971 Census, 235,890 have been allotted on the basis of estimates derived from the ABS post-enumeration survey.

Source: Commonwealth Bureau of Statistics: Australian Census. See Barnes and Lamberton (1976); Lamberton (1977b).

APPENDIX C

3. AustraliaTABLE 2. THE STRUCTURE OF THE AUSTRALIAN WORKFORCE 1911-1971: INDUSTRY APPROACH^a

SECTOR		1911	1921	1933	1947	1954	1961	1966	1971 ^b
PRIMARY	Total %	586,148 30.2	598,695 26.1	656,316 24.1	552,410 17.3	554,669 15.0	513,286 12.1	512,994 10.6	479,780 9.2
SECONDARY (Manufacturing)	Total %	540,485 27.9	697,810 30.4	832,452 30.6	1,015,655 31.8	1,371,851 37.1	1,539,776 36.4	1,775,910 36.6	1,721,242 32.8
TERTIARY (Service)	Total %	643,938 33.2	789,837 34.4	933,479 34.3	1,033,056 32.3	1,256,665 33.9	1,449,639 34.3	1,675,814 34.5	1,878,010 37.7
INFORMATION	Total %	167,969 8.7	209,948 9.1	272,465 10.0	362,776 11.3	481,409 13.0	636,955 15.1	794,912 16.4	1,002,835 19.1
INDUSTRY INADEQUATELY DEFINED OR NOT STATED	Total %	- -	- -	23,907 1.0	232,534 7.3	37,428 1.0	85,440 2.1	96,825 1.9	58,561 1.2
TOTAL POTENTIAL WORKFORCE	Total	1,938,540	2,296,290	2,718,619	3,196,431	3,702,022	4,223,096	4,856,455	5,240,428

^a Includes Unemployed.^b 158,322 of those originally classed as 'Industry Not Stated' have been allocated on the basis of estimates derived from the ABS post-enumeration survey for 1971.

Source: Commonwealth Bureau of Statistics; Australian Census. See Barnes and Lamberton (1976); Lamberton (1977b).

APPENDIX C

4. West Germany

OCCUPATIONAL GROUPS OF A PREDOMINANTLY INFORMATIONAL NATURE

JOB CLASSIFICATION	1950	1961	1970
Printer, etc.	117,800	163,000	188,870
Engineers	184,300	363,300	425,977
Chemists, Physicists, Mathematicians	21,500	21,300	41,469
Draftsmen, etc.	84,400	156,100	221,548
Wholesale/Retail Buyers	730,250	999,900	1,051,573
Bank Employees, Insurance Agents	185,900	264,200	446,191
Forwarding Agents, Advertising Agents	99,300	121,400	176,217
Telecommunication Employees	162,500	300,700	212,737
Store-Room Clerks	83,850	216,360	169,930
Managers, Public Administrators, Chartered Accountants	708,400	681,300	646,279
Clerical Assistants, Programmers, etc.	1,268,400	2,651,900	3,606,161
Lawyers, etc.	44,500	63,700	72,891
Journalists, Translators, Artists	166,000	177,300	217,036
Teachers	249,200	311,400	459,754
Other Professionals	9,200	9,700	39,408
Total	4,115,500	6,501,560	7,976,041
Total Work Force	21,951,034	26,428,197	25,970,939
Occupational Groups of a Primarily Informational Nature %	18.75	24.60	30.71

Source: Lange and Rempp, 1977.

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PART 3

Long-range Communication Policy and Planning

Dan Wedemeyer

INTRODUCTION

APPROACH AND PURPOSE

This report provides a broad approach to the complex problems associated with designing long-range communication policies and plans. It draws most heavily from four areas: General Systems Theory (GST); Policy and Planning Science; Futures Research Methodologies; Communication Needs, Resources and Rights.

Figure 1 depicts the orientation of the report and relationships of the concepts.

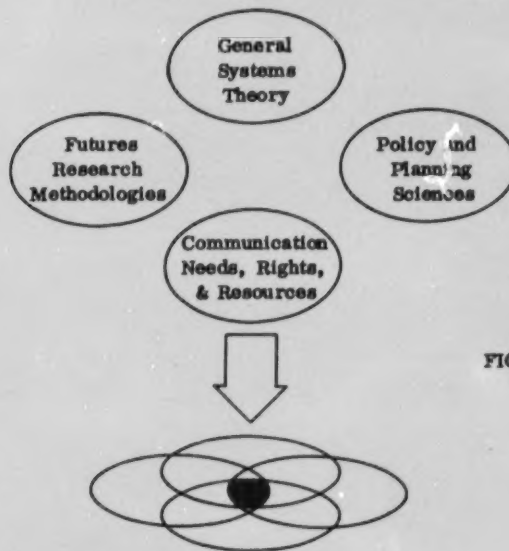


FIGURE 1

In figure 1, as in the report, the focus is on the synthesis of the key concept areas. Communication policy and planning activities are first defined regarding needs, rights, and resources. Chapter two concerning General Systems Theory (GST) provides the main theoretical base for the approach. GST is subsequently related to general futures research methodologies and to the decision and design processes of policy and planning. Finally, two specific futures methodologies, Delphi and Cross Impact Analysis, are related to GST and communication policy and planning processes.

The approach advanced in this report stresses long-term operational application of GST to research and communication management situations. Management regards the allocation or creation of resources to meet specified human needs.

Each chapter of this report makes explicit the concept in its individual form and elaborates on its inter-relationships to one or more of the other key concepts. It is intended that the final outcome will involve an intellectual synthesis and a framework for practical communication policy and planning application. An application of the proposed approach is detailed in chapter six of this report and deals with long-range policy and planning of

This systems-oriented process involves: an open planning concept of problem definition and evaluation; the development of a communication policy and planning data base; internal and external validity checks; model development and adjustment; policy and planning simulation, actions, evaluation, research and feedback. The process incorporates all four of the previously mentioned concepts into a communication management structure.

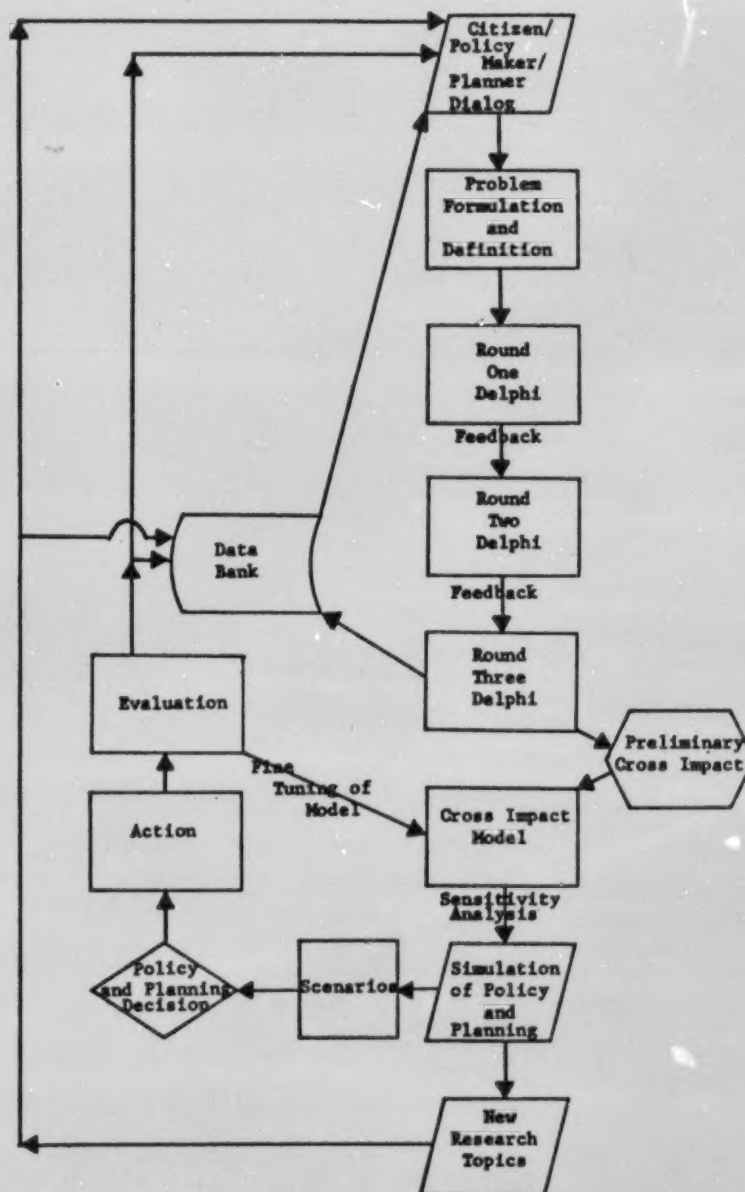


Figure 2. A Cybernetic Management Structure for Communication Policy and Planning

THE PROBLEM

The problem is that long-range, systematic approaches utilizing communication needs and rights to guide resource development and usage have not generally been taken.

The fundamental macro-relationship between a society's future communication needs and resources has not been systematically studied, theoretically developed or modeled in order to facilitate such an approach. Technical communication resources have heretofore defined the limits and satisfaction levels of human communication needs in a given society. This situation has evolved, in part, out of necessity, but is largely because of the inability of decision makers to conceptualize the macro-system, with its detailed and intricate relationships, and make complex future-oriented policies. United Nations Secretary General Kurt Waldheim (1972) points to the long-term dangers inherent in this problem:

Failure to assert the primacy of policy over technology is an alarming and increasingly dangerous phenomenon of the modern world. All too often, those responsible for the future development of technology are insufficiently aware of the far-reaching political, economic and social implications of their choices. This danger is present also in the area of communication. Unless that danger is removed, future developments in the fields of communication may well produce consequences which were neither foreseen nor desired from a more comprehensive national and international perspective. Often such consequences can only be modified later at considerable cost, if at all. (emphasis added)

There is an increasing awareness that communication policy and planning are essential components in national and international development. Recent international communication literature suggests that the problem is directly concerned with the need for action-oriented policy research that utilizes approaches and employs methodologies that are valid, widely generalizable and applicable to future communication policy and planning situations (see Unesco COM/MD/20, 1971; Unesco COM/MD/24, 1972; Unesco No. 74, 1975, Unesco No. 76, 1976). This research requirement was recognized nearly four years ago at the meeting of experts on communication policies and planning in Paris (COM/MD/24: 1971, p. 4).

Policy makers are increasingly aware that, in the allocation of natural and social resources, future-oriented policies can no longer afford to ignore the communication dimension. . . . The returns to be gained from viewing a nation's diverse communication activities as a whole, and projecting them into the future against the needs of society and the individual, are worth the effort, vital and urgent. (emphasis added)

Increasingly, communication research should be approached both systematically and with heightened awareness of the future environment in which the policies and plans must serve. Attention must be drawn to the evolving requirement that communication needs and resources should be the prime consideration in subsequent policy and planning research.

Communication infra-structures and personnel (both internal and external) can be treated as a societal resource. Like all valuable resources, these can and should be managed properly. This requires that decision makers have access to an adequate information base. Parts of what this information base should contain have been outlined by reports of several organizations and countries (Unesco No. 76, 1975: 42; Australian Telecom 2000, 1974; Proposals for Communication Policy for Canada, March, 1973). Continued and more detailed specification can be expected as national activities in communication policy formulation and planning increase. Generally, these information bases are organized around a logical and realistic framework that provides an over-all picture of macro-communication relationships and past and evolving patterns in a given society. These data can be used to refine national policies and adjust developmental or functional plans.

Defining, establishing, and maintaining the information base is an evolving joint responsibility for the communication researcher, the citizens, the policy makers, and the planners. Toward this effort, the communication researcher must insure that the information base and to a lesser extent the methodologies used in establishing it, are appropriate, valid, and understandable to the citizen and to the decision makers who use the information. The data base must be broad and have at its core a general model of the present and future communication environment.

Because communication in society is not limited to specific disciplines, geographic frameworks, or economic separations, a multidisciplinary approach is necessary. A "multi-logue" between citizens, policy makers, and planners should be facilitated by a general framework that promotes problem formulation and long-range solutions.

PURPOSES OF COMMUNICATION POLICY AND PLANNING RESEARCH

Communication research has been specified as serving four general purposes:

supplies basic data and general findings to policy makers;

helps planners to elaborate alternatives for policy makers;

contributes to examination of the communication processes in the whole of the social life by elucidating the basic laws and principles of social/human communication;

evaluates the results and impact of communication activities and feeds back information to the system (Unesco COM/MD/24, 1971: 17).

The approach in this report incorporates these as well as stressing the interactions of economic, socio/cultural, and political communication needs, resources and rights. This general methodological framework lessens the likelihood that "closed, management by crisis" situations will evolve.

APPLYING FUTURES RESEARCH METHODOLOGIES TO POLICY AND PLANNING

Selected futures methodologies can be directly applied to communication policy and planning situations. This is based on the assumption that virtually all policy and planning decisions are made to serve in a future environment. Most likely this environment will be quite different from the present environment in which the decisions and plans are made. This does not mean that they are mere exercises in imagination. On the contrary, systematic approaches to obtaining future-oriented data and modeling the relationships of that data already exist.

Most notably, the Delphi technique and cross impact analysis (see Chapters 4 and 5 of this part), have proven to be effective methods of structuring a group communication process in order to deal with a complex set of future-oriented problems. The latest, most complete source (Linstone and Turoff 1975) contains over 700 citations concerning the philosophical bases, general applications, evaluation, and pitfalls of these two techniques.

Unlike the Delphi technique, which has been applied in many and varied problem areas, cross impact analysis is an evolving technique and has had limited general application. No formal application of cross impact modeling can be found in the areas of communication policy and planning. It will be shown that such an approach is important to advancing policy and planning sciences.

TOWARD MODELING THE FUTURE POLICY AND PLANNING ENVIRONMENT

Applying Delphi and cross impact analysis to the construction of policy and planning models allows the inquiry to be structured and induces problem centered dialogue. Utilizing Delphi inputs and cross impact analysis techniques allows further refinements of the data. Cross impact analysis forces a systematic assessment of the relationships of each individual pair of trends and events. Once developed and tested for internal consistency, the model can be used to simulate the probable consequences of specific policy decisions. In addition, the model can be used to generate representative scenarios for alternative policy and planning purposes (Helmer 1975).

Cross impact analysis is one method of building structure around forecasting data. It has been in development for more than eight years and is presently in its sixth generation of programming. As elaborated later, Delphi and cross impact analysis have great potential as futures research methodologies as well as decision making aids in the policy and planning process.

PROBLEMS IN APPLYING FUTURES RESEARCH METHODOLOGIES IN POLICY AND PLANNING DECISIONS

The Delphi technique and cross impact analysis, like all social science research methodologies, are not panaceas for problem solving. As communication, forecasting, and modeling methodologies they have the potential of providing new insights in policy decisions. Nonetheless, there is need for further research and refinement in both approaches.

Specifically, Delphi can be refined and advanced as a communication device as well as a forecasting methodology. As a forecasting device Delphi has problems concerning rating and improving the abilities of

experts in making forecasts. These problems have been eased by peer and self-ratings, but lack perfection. Additional problems include: defining and selection of experts to serve on the panel; consensus vs. divergence; the stability of the panel over time of the inquiry; and a problem of validity and reliability of the forecasts attained by a Delphi inquiry.

The most extensive criticism of the Delphi technique has been advanced by Harold Sackman, a former Rand researcher. As detailed later in this report, Sackman (1974) assesses the technique as it compares with traditional social science methodological standards. While his analysis has some value, it has been pointed out that he misses the real intent of the technique in his initial definition. In any emerging methodology, critical analysis and open debate are necessary to its evolution. Since Sackman's critique, there have been numerous articles and studies in defense of Delphi. An entire issue of Technological Forecasting and Social Change (1975) was devoted to countering Sackman's assessment of the technique. No doubt the dialogue will continue; however, it is clear that additional research is needed to resolve the critical issues.

IMPORTANCE OF THE PROPOSED APPROACH

It is increasingly important to adopt an open, future-oriented policy and planning approach to communication management. Such an approach should include methods of establishing and maintaining a working policy and planning computer model and a reliable information base. In addition, any good approach should be general enough that it can be adapted to and draw from other communication policy and planning projects in other world locations. The following statements summarize some of the advantages inherent within the approach presented in this report:

Such an approach suggests some present and future levels of communication needs and resources in a given society.

The approach involves both experts and citizens in an open policy and planning process.

The approach results in a computer policy and planning model which assists in decision making.

The approach incorporates a systematic, holistic and anticipatory dimension into the communication policy and planning process.

The approach suggests areas where additional research is needed in moving toward a policy and planning data base.

The approach provides a framework that can be modified and applied to other locations in regard to communication policy and planning activities.

The methodologies employed are capable of providing models of a "collective reality" in regard to future communication environments.

The Delphi aspect of the approach provides a structure for advancing dialogue and obtaining forecasts concerning possible communication developments.

The cross impact model defines and advances some important relationships between communication needs, rights and resources.

Both futures methodologies (Delphi and cross impact analysis) incorporate "rare events" (i.e. events with low probabilities of happening) into a policy and planning model.

The study develops a mechanism for generating alternative scenarios and exploring needs, resources rights, and tradeoffs in regard to future communication environments.

SUMMARY

Any viable methodological approach to communication policy and planning at a state, regional, or global level must incorporate existing knowledge and future developments (trends and events) into a broadly based macro model. The model should assist in structuring present dialogue and decision making while offering insights into alternative future resource and need configurations. In addition, it should provide information concerning the consequences of particular policy options. In short, this approach should provide a basis for decision makers to

understand and incorporate the multiple interactions and possible consequences of contemplated policy decisions, and at the same time, open the policy and planning process for increased citizen information and participation.

The following report will show that although policy and planning research is increasing, few countries have approached the problem in the proposed manner.

While it is not intended that this report provide a specific, defined, "cast in concrete" approach to communication policy and planning, it does advance one possible framework and some specific theories and methodologies useful in considering the complex and changing environment of communication policy and planning.

CHAPTER 1: AN OVERVIEW OF COMMUNICATION POLICY AND PLANNING IN REGARD TO COMMUNICATION NEEDS, RIGHTS, AND RESOURCES

INTRODUCTION

At present, communication policy and planning sciences are in a stage of development and transition. Most communication researchers, public policy makers, planners, and citizens are becoming aware of the overwhelming number of technological and social alternatives available, but are less aware of procedures for setting priorities and synthesizing collectively viable actions.

Ithiel de Sola Pool (1974, p. 4) noted:

The public policy makers in every country must deal with problems arising from rapidly changing communications technology. How to evaluate, orient, and control the consequences of this new technology is coming so rapidly, the alternative possibilities are so many, the technology is so sophisticated, that governments are bewildered. Virtually anything that one wants to do is doable--at a price. The problem is how to make intelligent decisions in an area in which the facts are hard for laymen to understand, the economics beset by externalities, the politics ridden by powerful vested interests.

This complex situation is further complicated by insensitivities and a lack of understanding between the very groups that should be developing dialogue.

Specifically, citizens point out that policy makers and planners are not involving them in what (in many cultures) is supposed to be a "public" process. Communication researchers add to this criticism by pointing out that policy makers and planners do not take research findings and recommendations into consideration when making decisions. These two positions are countered by policy makers and planners who state that citizens are apathetic and, in some respects, lack the required expertise to solve complex social and technical problems. Finally, the policy makers and planners point out researchers are not problem-oriented and cannot make research findings available in the context of the time frame required to make "real world" decisions. To a neutral observer, if there is one, it is clear that each group holds views that contain some "elements of truth." What is less clear is the proper approach required to develop a meaningful dialogue.

The problem is one of setting up a viable framework for research and public dialogue so that information can be compiled, synthesized, and exchanged to improve policy and planning actions. Activities of this nature can be categorized under the general headings of "open planning" and "policy and planning 'action' research."

Such approaches involve open discussions and co-determined research agendas with regard to communication needs, rights, and resources. This has been advanced in a recent working paper, Issues in Communication Planning for Hawaii (Barber, Grace, Harms, and Richstad 1975). It sets out:

a program of discussion and research . . . on communication needs can be expected to yield:

- a set of criteria for defining a communication need . . .
- a list of defined communication needs . . .
- a procedure for organizing defined communication needs . . .
- a procedure for translating communication needs into technical and operational requirements . . .

- a procedure for estimating the quality and quantity of the communication resources and incident communication facilities necessary to satisfy the communication needs of a society . . .
- a procedure for monitoring communication need satisfaction in a community.

Defining, setting priorities, and translating these needs into technical and operational requirements involves the input of a diverse set of disciplines and world views. It is simply not possible to approach the problem in a uni-disciplinary manner. An integrative approach must be taken by policy and planning researchers. In this regard Amara states:

The distinctive characteristics of policy research are that it is problem oriented and integrative--in other words, it seeks to draw together many disparate elements in an effort to shed light on real-world problems. Normally subsumed by it are activities such as forecasting, planning, and strategic and operational decision making. Its lexicon includes considerations of values, goals, attainments, and indicators or measures of performance. (emphasis added) [1972, p. 603]

It is this general approach that policy makers, planners, and communication researchers must take if they hope to make operationally meaningful contributions to public policy and planning activities.

To this already complex situation two other important elements must be incorporated; the elements of time and change. The time parameters must be clearly defined and incorporated into any viable approach to policy and planning. Rapid social and technical changes are usually associated with the environment in which communication policy and planning take place. Australia has recognized these key elements, and the associated problems, in their recent efforts to plan telecommunication resources to meet future societal needs. The following statements are found in Telecom 2000 (Australia 1975, p. 2):

How can we plan for telecommunications in a future society? . . . We are faced with the task of planning new services for markets which do not yet exist, complex technologies which are rapidly changing and a socio-economic environment which, it is widely agreed, is becoming increasingly unstable and turbulent.

Present turbulence and future uncertainty account for many problems in the policy and planning process. These difficulties must be incorporated in any efforts involving citizen dialogue and the development of a framework for research.

COMMUNICATION POLICY AND PLANNING AS AN ORGANIZED RESEARCH ACTIVITY

In recent years there have been a large number of research activities and institutions initiated. Pool (1974) has noted nearly twenty-five worldwide programs or institutions focusing directly on telecommunication policy and planning. Most all of these institutions have emerged since 1972 or have adjusted their emphasis to include communication problems since that time. A summary of Pool's description of these institutions and their research programs gives an indication of the rapidly emerging world-wide concern for communication policy and planning research. Pool (1974, pp. 33-35) notes that research dealing with cable television policy is being conducted at Lehigh, Michigan State, and Michigan University. The University of Pennsylvania also deals with the related area of policy and economics of new telecommunication services. Rice University is investigating television network regulation; Massachusetts Institute of Technology is investigating new ways of providing land mobile radio service. North Carolina State University has projects concerning telephone regulation, and the University of Southern California is exploring the use of communication technologies as a substitute for travel.

Other programs include Rand Corporation's analysis of economic and technical possibilities for cable television and related work being done at Stanford University and MITRE Corporation. Social and political issues of new communication technologies are the focus of the Aspen Program. There is a general program on communication policy at Harvard University and a program of communication law at UCLA Law School. Universities dealing with general policy and planning areas include: Brookings Institute, Yale, California Institute of Technology, and Washington University.

At the federal government level, the United States offices of telecommunication, both in the White House and in the Department of Commerce, and NASA's continuing research and experimental programs are indicators of the widespread American interest in communication policy and planning.

This increase interest is not limited to the United States by any means. Pool goes on to point out that there are ongoing programs concerning telecommunication substitution for travel and teleconferencing in England, satellite research programs in India and Brazil, and comprehensive communication policy studies dealing with

terrestrial broadcasting in Samoa, Salvador, and Iran. In addition to these, Japan and Finland are actively involved in a wide-range of communication policy and planning problems.*

Other regional or world examples of an increased interest in this regard include the ongoing six-year communication policy and planning project at the East-West Center's Communication Institute in Honolulu, the Pacific Educational and Communication Experiment (PEACESAT) at the University of Hawaii, and two United Nations agencies, Unitar and Unesco. Unitar has been studying the communication needs of the United Nations and its affiliated institutions, while Unesco "has probably done more than any other single organization to promote study and research of the communication needs of the developing areas" (Pool 1976).

This gives an indication of the scope of concern worldwide with these complex problems. Such a wide foundation of communication research properly organized and coordinated could supply relevant information in moving toward planning data bases for national and international policy makers.

Unesco (No. 76, 1976, pp. 28-29) has established a research foundation consisting of three main sections: Communication and Planned Social Change, Mass Media and Man's View of Society, and Research into International Communication Structures.

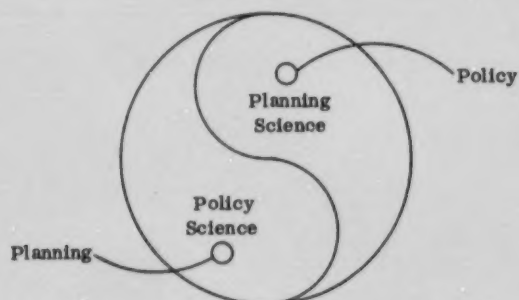
In the first section on planned social change, it is intended that "such research, carried out nationally and coordinated at the international level should ensure the cross-national comparability of the research studies involved, and should also enable the experience of one country to contribute to the better development planning and the communication strategy of another." The framework for this research should logically start with the requirements of policy and planning process. It should take into consideration the dynamic process of altering communication needs as they relate to advancing communication resources.

The second section of the Unesco research proposal concerns man's view of society and addresses the need for a multinational program of communication research. Here "the 'multinational quality' would be manifest in the cooperation between nations and institutes in formulating the research, in order to ensure the comparability of the results of long-term studies of the whole of a communication process in a number of different countries" (1976, p. 29).

The third section of the proposal calls for research into international communication structures. This approach offers a broad framework for the coordination and usage of national research activities and outcomes. "The implications and effects--social, political, legal, cultural, moral, commercial, educational, etc. are of enormous importance in the formulation of national communication policies and planning" (1976, p. 29). This three-point proposal addresses the need for a general framework for policy and planning research and provides a foundation for the specific approach advanced in this report.

THE RELATIONSHIP OF POLICY TO PLANNING

The relationship between policy and planning is intricate and sometimes confusing. In one sense, policy formulation is subsumed in the overall planning process of communication, but in another sense, policy and planning can be viewed as a separate and independent science. This relationship could be shown as:



* It should be noted that this list is by no means exhaustive--since Pool's 1974 discussion, several telecommunication policy and planning projects have emerged worldwide.

This implies that both planning and policy sciences can and should maintain separate and independent identities, yet, in each there is an element of the other. To make policy is to plan, and to plan one must employ broader policies guidelines.

The Yin/Yang nature of the relationship should, in theory and practice, tend toward balance (that is, one would not plan to the exclusion of policy and policy making should not be carried out in isolation from planning considerations). This balance is sometimes mistaken as an overlap in function; the two processes are separate but interrelated.

Although the policy and planning process is complicated, the complexity should not preclude it from being ordered and managed effectively. The overall communication management process involves clearly identified stages, which include: policies, strategies, operational planning, and budgeting. Ideally, these would be followed in an orderly, cyclical manner; in reality, however, "planning and operational application can precede the formulation of policies (Unesco No. 24, 1972, p. 13). This juxtaposition usually arises when there is an urgent need (crisis) to satisfy immediate communication needs for networks, and to achieve immediate ends at the expense of considering long-range social or cultural effects. The result may be considerable waste, and unexpected social dissatisfaction. It is therefore necessary "to step forward cautiously from present practices to future policies and decisions" (Unesco No. 24, 1972, p. 13). These "cautious" procedures require an integration of long-range policies with day-to-day practices in order to reduce resource wastage and social or cultural dissatisfaction.

In this regard there is a continuing need to develop a dialogue between policy makers and operational planners and an ongoing mechanism for citizen input. This dynamic process is important if changing social needs and communication resources are to be appropriately balanced.

This approach was advanced in an early policy and planning document published by Unesco (1971, p. 7). It sets out that "communication planning can only be realistically executed within the framework of communication policies defined as appropriate to the political and social structures and the communication needs of the society." This internally cooperative arrangement between researchers, citizens, policy makers, and planners can be further supported by external advice and research. To indicate the rich relationship between communication policy and planning the following Unesco planning process can be cited. The process involves the following:

1. The collection of basic data and a systematic analysis of the country upon such bases as population densities, geographic limitations to communication, variety of social structures, ecology and agriculture, transportation, physical communications, mobility of population, electrification, industrial capacity, manpower capacity, etc.
2. The production of an inventory of the present communication resources (as defined in Annex I) including modern and traditional media and analyses of the variety of present communication structures. Such an inventory should also include the study of the audience, its communication consumption patterns, etc.
3. The critical analysis of present communication policies (or lack of policies) including such considerations as ownership, structures, decision-making, etc.).
4. The critical analysis of the communication needs of each society especially in relationship to the existing social and communication structures and the uses to which communication is put.
5. The analysis of the communication components in all aspects of the national development plans and programs in order to ascertain the communication requirements of the programs, the communication capacity which is essential to the execution of the plan. These needs must then be reconciled with the means and capacity available.
6. An analysis of the constraints on communication developments and structures.
7. The definition of aims, objectives of future communication policies. The study of future needs and the projection of possible strategies and the structures to support them and the design of alternative approaches including their requirements for personnel, hardware, finance, research training, commensurate with the values and goals of the society.
8. The analysis of the economic, social, cultural, educational relevance of the alternative communication strategies and structures and upon the basis of all these various scales of relevance making the choices which are necessary to implement plans and programs.

9. The phasing of overall development of communication systems in a logical sequence matching the needs as assumed under present and future conditions as part of national development policy and planning. (emphasis supplied by Unesco) [Unesco No. 20, 1971, p. 7]

This process incorporates the key features of the policy and planning process and its relationship with present and future communication needs and resources. In addition to these key features, it is important to recognize that this process is not purely national in nature. Constant reference must be made to international systems involvement. This is because "states are called upon to frame their national policies with due regard to a number of widely accepted international agreements and standards,"* (and) countries are vitally concerned with desirable or undesirable communication with other countries, the outward and inward flow of information" (Unesco No. 24, 1972, p. 14).

OPEN PLANNING

The concept of open planning is rapidly emerging at local, regional, and national levels. This is because of "a latent suspicion of planning by large government organizations, and a fear of the possible adverse effects of future technology" (Newstead 1975, p. 1058). Open planning is defined as "the process by which an organization achieves to a greater or lesser extent, public involvement in its planning decisions." This concept is similar to the concept used in "open system," that is, it "attempts to differentiate planning which is aimed at systems subject to the laws of thermodynamics and hence increasing entropy (that is, closed systems) from planning which is aimed at systems which are capable of interacting with their environment . . . (open systems) [Young, nd].

In the past, communication planning was a relatively closed process because little visible impact was associated with the process. Citizens are increasingly experiencing threats to personal privacy from communication media; the inability to gain access to or influence the utilization of "public" airwaves, etc., and are consequently discovering the power associated with the policy and planning process. Those few who have been charged with, or have taken on, the responsibility of allocating communication resources have held the "power to bring about major social transformations--changing the nature and places of work, education, and leisure, the shape of cities, and the transportation systems that service them" (Newstead 1975, p. 1058). This centralized power is increasingly being challenged at public debates, seminars and workshops.

The growing need for developing approaches for wider participation in the planning and decision-making process has been recognized by the National Telecommunication Planning (NTP) branch of the Australian Telecommunication Commission. This statement appears in the Telecom 2000 report (1975, p. 148):

There has been a growing uneasiness about the 'style' of government and administration at all levels. . . . The feeling is that traditional processes . . . are in danger of becoming too remote, too 'out of touch', unresponsive; that processes need to be devised which ensure that the community continuously participates in planning and decision-making processes at appropriate stages. . . . The call is for some sort of broadly based, flexible open planning. (emphasis mine)

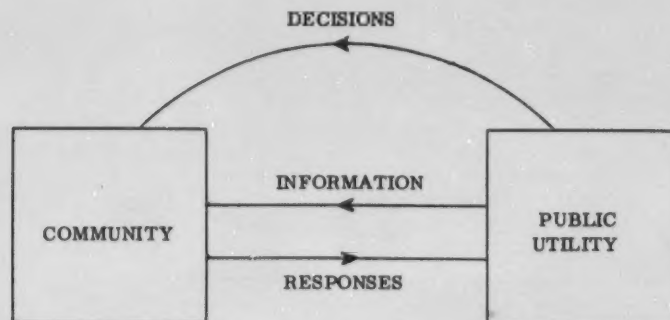
The need to devise mechanisms to open the planning process has also been recognized by Alvin Toffler (1972). The terms used by Toffler to describe this evolving need are social futurism and anticipatory democracy. He criticizes technocratic planning as suffering from the "virus of elitist" (Toffler 1972, p. 117) and calls for a "new kind of information system in society; a loop rather than a ladder" (Toffler 1972, p. 121). Toffler views planners as being "remote" and "ignorant" in regard to local conditions. This causes suspicion that "top-down controls are unworkable" (Toffler 1972, p. 99).

There are formidable problems associated with opening the planning process. These involve a proper balance between community participation and planning "experts." As Newstead (1975, p. 1063) points out "no one would suggest that an airliner designed by a community would be preferable to one designed by Boeing or Lockheed, but the fate of the American supersonic transport shows just how wrong technologists can be in their judgment of what a society wants." (emphasis mine)

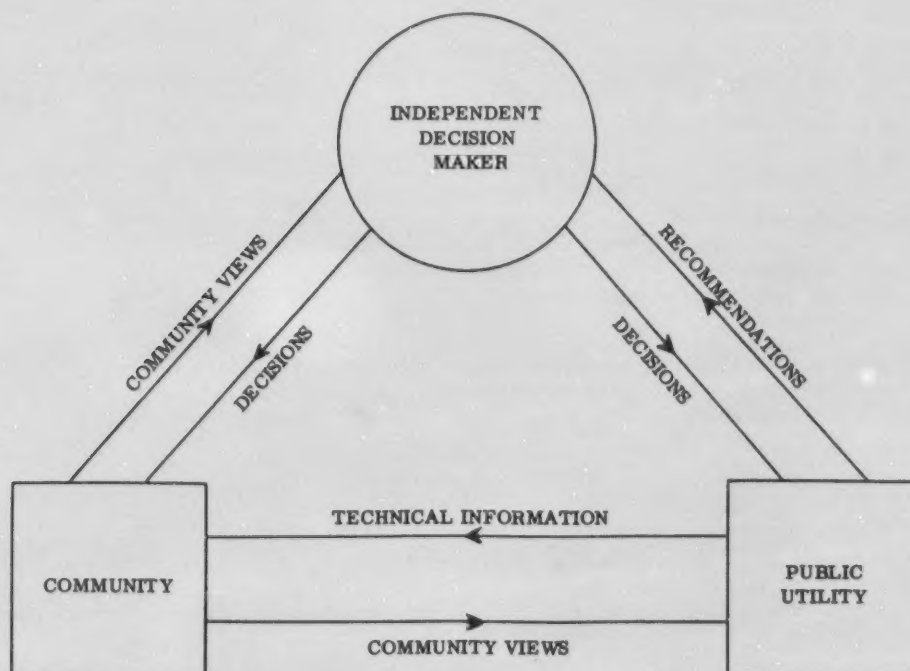
* Some suggested in the Unesco report which are of particular importance to communication policy makers are: Charter of the United Nations; Universal Declaration of Human Rights; The Outer Space Treaty of 1967; The International Telecommunication Convention and its Radio Regulation; The Universal Copyright Convention, the Berne Convention, the Rome Convention on Neighboring Rights; The Unesco Agreements on the Importation of Education, Scientific and Cultural Materials.

The question is--just how decentralized and participatory should the planning process be? Procedures that strike a proper balance between technological and social expertise and public participation must be developed. Decentralization of planning as Newstead (1975, p. 1059) has pointed out, will enhance the "capabilities of complex systems to survive in a turbulent environment." This de-specialization aspect of planning encourages "redundancy of function" and provides "both ethical and pragmatic arguments for opening up the process of forward planning of public utilities." (Newstead 1975, p. 1059)

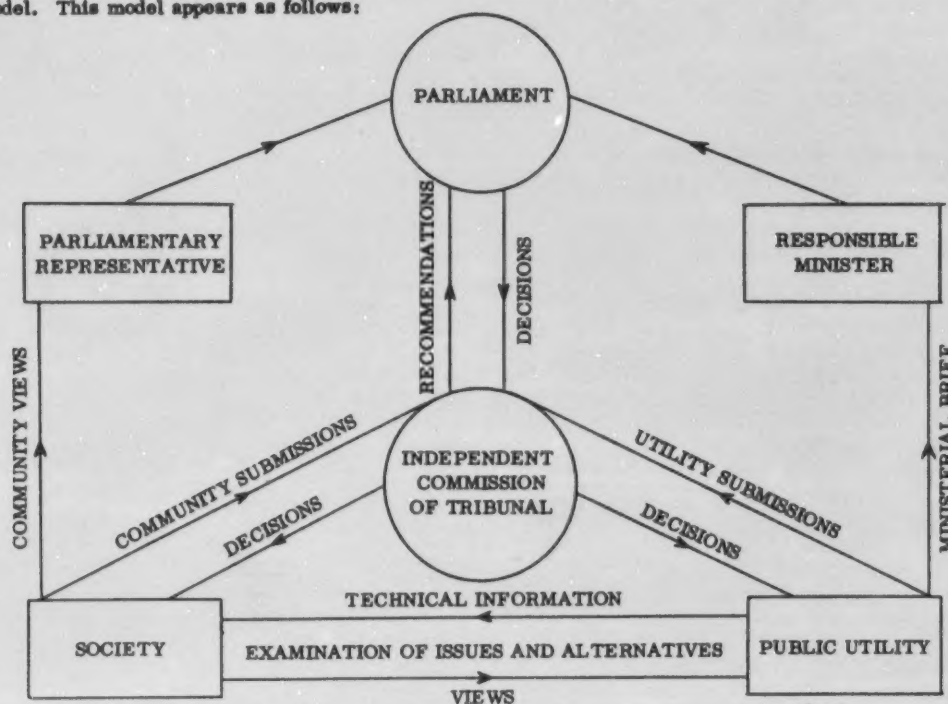
The process of opening the planning process involves developing a viable framework and the establishment of information and data networks to encourage and support meaningful dialogue. A number of frameworks have been proposed by the Australian Telecommunications Commission. The process in its simplest form involves the community and the public utility. The basic process is as follows: (ATC 1975, p. 151)



It may be advantageous to add an independent decision-maker (a Tribunal or commission) to this basic process. This model would then appear as follows:



Finally, and probably more realistically, (at least nationally) the political process is incorporated into the model. This model appears as follows:



The three models are only examples of possible configurations. What is key in each model, however, is the two-way information flow among the elements of the system. Regardless of the open planning model adopted, this element of dialogue should be maintained.

The incorporation of larger and larger numbers into the social decision-making process will require that systematic methods be developed to collect, synthesize, and feedback data. A professional/technical staff would "provide data on the social and economic costs of various goals, and . . . show the costs and benefits of proposed tradeoffs, so that participants would be in a position to make reasonably informed choices . . . among alternative futures" (Toffler 1972, p. 125). (emphasis mine)

Open planning is essential to any workable communication policy and planning process. It is key to maintaining a balanced relationship between citizen needs and technical resources in a complex and turbulent environment.

COMMUNICATION NEEDS, RESOURCES, AND RIGHTS IN COMMUNICATION POLICY AND PLANNING

COMMUNICATION NEEDS

The subject of communication needs is central to the discussion of present or future policy and planning. It is unfortunate, but nevertheless true, that human communication needs have not been key to all past policy and planning decisions. Part of this omission is due to the communication researchers inability to provide decision-makers with a clear specification of what communication needs exist and what priority is placed on each need. In this regard, Barber (et al. 1975, p. 5) states that "at present, there does not appear to be in Hawaii or elsewhere a public consensus on what the basic human needs are . . . in the future, our interests in long-range planning will require that we do know what human needs are, and whether they are stable or changing."*

* One of the findings emerging out of the study reported in Chapter six. While it was shown that communication needs change over time the relative position of each need changed very little.

In approaching this problem it is useful to specify human needs in general and from this foundation stipulate how communication needs are related. Lesse (1976, p. 531) defines human needs as:

those factors which, when satisfied, permit and aid an individual to function either alone or in a group, in a given milieu, with optimum ability to adapt to or to modify the human-environmental equilibrium, in order to guarantee survival with pride and pleasure.

This definition links the satisfaction of needs with the ability to adapt or modify the relationship between a human and his/her environment. In a rapidly changing environment, increased information is necessary to guarantee survival or maintain equilibrium. In this respect, general human needs are closely related to information or communication needs. Human needs change as a function of the changes in determining factors (that is, individual, social, and environmental). Therefore, a present communication need probably will vary from a future need.

One approach to the specification of human needs which somewhat disregards variance over time is that of Maslow (1970). It can be argued that although Maslow's hierarchy of needs does not change, the method of satisfying them, or information needed to satisfy them, does change. In this regard then, one could specify particular information or communication needs as they serve Maslow's hierarchy of needs.

Physiological needs such as air, water, food, shelter, sleep, sex

Safety and security needs

Esteem needs (from self and others)

Growth needs such as aliveness, order, and meaningfulness

Communication serves Maslow's physiological or safety needs only slightly. It is needed in a "coordination" or "appropriation" sense, but is not closely tied to the first two levels of needs. This is less true as one moves up the hierarchy. Maslow's third level, growth needs, is most dependent upon communication for fulfillment. In other words, communication needs appear to increase as a function of a society's level of concern or "quality of life." A society at subsistence level simply does not have the communication needs of a more highly developed society.

Other frameworks for studying communication needs have been advanced by Sowter and Wearing (1975, p. 17). Although they deal most directly with social implications of development in telecommunication, they set out three approaches to the problem that provide functional frameworks for communication needs analysis.

The first approach is sectoral analysis, which involves the study of various sectors of the economy or geographical regions. This approach is rejected by Sowter and Wearing because "there is no agreed understanding of how economic activity in society should be partitioned . . . (and) the economy forms only one part of society." (emphasis added) Although Porat (1977) might object, communication need analysis from a purely economic approach is rejected in favor of a broader framework.

The second approach involved "partitioning society into three parts: the socio-economics, polity, and the culture." The socio-economic subsystem includes economic, technological, and occupational systems. Polity concerns the distribution of power and control, including political and legal activities. The culture subsystem is concerned with symbolism, meaning, and myths." This rather traditional approach does not differ significantly from Parson's (1970) structure for social systems analysis.

The third, and final approach set out by Sowter and Wearing relates communication to societal changes in general. This approach regards the environment as turbulent, which, it is concluded, increases the need for effective communication. This approach views the needs process as a dynamic interaction between a particular communication system and the environment itself, a problem of balance.

Of these three structural approaches, the second approach involving socioeconomics, politics, and culture seems to lend the strongest structural framework for societal communication needs (resources, rights) analysis. Excluded by this approach, however, is the psychological dimension. By combining these approaches, with primary emphasis on the second, a synthesized framework capable of assessing societal communication can be formulated.

		SOCIO	ECONOMIC	POLITIC	CULTURAL	PSYCHOLOGICAL
COMMUNICATION	TREND					
NEED	EVENT					
COMMUNICATION	TREND					
SUPPLY	EVENT					
COMMUNICATION	TREND					
RIGHT	EVENT					

Each cell provides an area of concern for specifying particular communication developments in terms of trend levels and event probabilities. For example, the particular cell created by the intersection of the communication needs/trends in the political category would be used to generate such questions as the present and future need for citizen involvement in political decisions or openness in government. The communication rights/psychological cell would suggest items concerning privacy or security communication. In short, each cell would prompt appropriate questions concerning communication needs, resources, and rights.

In summary, the determination of specific communication needs, their priorities and intensity, is important if policies and plans are to move from a technological emphasis to one of a more human orientation. Barber et al. (1975, p. 8) support this contention:

A communication need must be known precisely enough to decide what kinds of communication technology (resource), if any, is required to serve that need (and) a communication need must be known exactly enough to determine what communication policies, if any, are required to be sure that technology serves that particular need. (emphasis added)

Simply, human communication needs must be closely tied to resource considerations. In this sense, the specification and elaboration of needs can be considered a necessary prerequisite for subsequent policy and planning actions concerning communication resources.

COMMUNICATION RESOURCES

The potential for societal communication, that is, the communication infrastructure is a fundamental resource. Without communication, as Krippendorf has pointed out, there is no societal structure (1971, p. 171). In this sense then, communications resources are a pre-condition for all societal actions. The communication links (resources) determine the structure and process of the system. Krippendorf adds (173) that "the nominal definitions of structure often refer to sets of relationships." A set of relationships can be considered a network or system of channels. The abundance and richness of a society's networks is a fundamental determinant of the level and quality of life. Communication resources, then, can be considered a system of channels that determines the richness of interaction and quality of life in a society.

The analysis or specification of communications resources must also include information in the discussion. In its Annual Report (1975-76), the Harvard program on Information Resources has pointed out the general importance of resources to policy and planning. The report states:

Resources are fundamental building blocks of organized activity. Resources are pervasive. They are the sources of strategic strength and strategic weakness. Any imbalance in resources can result in disaster; any advantage in resources can result in triumph. Resources merit the attention of the highest political processes (1976, p. 4).

Both information and communications can be considered resources in this sense. They are fundamental to organized activities, sources of potential strengths and weaknesses, and their imbalance can result in disaster or triumph.

It is necessary to specify what is meant by information in this study. As Singh (1966, pp. 8-9) has pointed out, it is difficult to define information because "it is an amalgam of so many vague and imprecise meanings that a scientist has to purify from the blend of its diverse connotations the one he requires for his purpose." For the purposes of this study, a purely mathematical definition is not appropriate. Alfred Kuhn provides the following useful discussion and definition of information:

A controlled (adaptive) system cannot respond to its environment unless it possesses information about it . . . consider pattern to be synonymous with information, mainly on the grounds that I think information theory and communication theory can sensibly be said to deal with pattern and pattern transfer . . . we do not normally think of a pattern as information if we can learn only about that pattern by examining it. Only when examining a pattern enables us to make inferences about something else do we think of it as information. Information might therefore be viewed, and tentatively defined, as some aspect of a pattern that enables an observer to make inferences about something other than the pattern itself (1974, p. 41).

Information is a fundamental building block, but it is entirely dependent upon communication for its utility. In this relationship, information can be considered "potential" energy, while communication can be thought of as "kinetic"--that is, information at work. Although information has the potential to influence all systems, it is communication that is responsible for it. Therefore, the way to control information resources in a society is to control communications resources. This control process is called policy and planning--the process that is employed to balance societal needs with available resources. The relationship is as follows:

- Information is pattern (Kuhn 1974, p. 150); it is a basic resource (McHale 1971; Ploman 1975).
- Communication is the transfer (sharing) of pattern between two or more parts of a system, that are identifiable in time and space, regardless of the materials of the parts (Krippendorff) (Kuhn 1974, p. 150).

With this relationship of communication and information in mind, it is useful to examine some characteristics of the two concepts. McHale (1971, pp. 11-12) specifies that information resources are somewhat different than physical resources in regard to usage and depletion. The following are some of the unique properties of information and knowledge resources:

- All other resources are dependent upon them for their evaluation and utilization.
- As resources in themselves, they are not reduced or lessened by increased use or wider sharing--rather they tend to gain in the process.

McHale's first point is important to the rationale for this study. If other resources are dependent upon the communication (of information) for effective evaluation and utilization, then communication takes on the properties of being a "neutral" or "facilitating" resource. In effect, if communication (of information) can be used to conserve, employ or tradeoff other resources, then it can be argued that it is substitutable, to a limited degree, for those other resources. Communication then takes on the value and the need characteristics of these other resource systems.

McHale's second characteristic is less acceptable than the first. It is questionable whether total information in the environment increases with sharing. In a narrower, shorter-term sense, information does appear to increase with use. However, as it does so, the resulting effects (determined by communication) are almost identical to the depletion of a physical resource. In other words, as information increases in availability (by use and synergism) beyond the capacity of humans to process and use it, it takes on the same utility characteristics as lower grade iron ore; it is simply too costly to process in order to obtain the small return. This important concept should not be overlooked in developing policies and plans in regard to information and communication in a society. Ultimately, a balance (regulated by human rights) between availability and scarcity of information will be the regulating factor in the communication policy and planning process.

As with other resources, control over the availability of communication and information is necessary in order to maximize need satisfaction. Governments have long understood this basis of power and control. Only recently has communications taken on the same importance as physical resources have had. The Malaysian Minister for Information has remarked, "because of the inherent power of communication itself, it should be regarded, primarily and principally, as a national resource, whether limited or not, subject to planned and coordinated development" (Unesco, Com74/Conf 713, 1974, p. 6).

Naessellund (1976, pp. 12-13) views the role and importance of information and communications resources as closely tied to world order. He states:

It is not until the political decolonization and the awareness of the importance of information created during the preparation of a new international economic order that the Third World recognized the vital role of information and communication at the national as well as at the international level (emphasis added).

Clearly, information and communication have deep seated implications in national as well as international development and relations. Communications and information are regarded as important societal resources and therefore require specialized policy and planning attention. Present and future availability of communication resources is fundamental to societal viability. Accordingly, it is necessary to include the concept in the framework put forth and used in this study.

COMMUNICATION RIGHTS

Directly related to the requirement to specify communication needs and resources is the concept of communication rights. This evolving concept goes beyond economically bound supply and demand considerations and addresses communication as a basic human right. A Unesco Report (19C/93, 1976, p. 7) concludes:

The changing world situation is bringing about profound changes in human communication. These changes are leading to new and enlarged perspectives. A strong relationship between human communication needs, the development of communication resources and human rights becomes evident. This relationship may be stated in the following way: mankind has the right to communication resources required to satisfy human communication needs.

This statement draws support from Article 19 of the Universal Declaration of Human Rights, which states:

Everyone has the right to freedom of opinion and expression. This right includes freedom to hold opinions without interference and to seek, receive, and impart information and ideas through any media and regardless of frontiers.

The Right to Communicate concept provides the final necessary component in this study and the framework for considering a wide-range of communication policy and planning problems. It is multicultural in scope and draws from the beliefs that communications is a societal resource, and that communication should be "a two-way, interactive and participatory process" (Richstad, Harms, Kle 1975, p. 10).

This participatory process affects communication rights at many levels. These include (Unesco 1976, pp. 4-5):

Individual rights, concerning such areas as freedom of opinion and expression, the right to inform or to be informed, the protection of privacy, freedom of movement, right of assembly, and access to sources of information.

Institutional rights, which specifically relate to access to sources of information, right to publish and inform, freedom of opinion, expression, and movement, and maintenance of professional secrecy.

Local, national, and international community rights, which addresses such issues as right to free and balanced flow of information, preservation of cultural integrity, cultural exchange, right to inform and to be informed, right of correction and reply.

The right to communicate carries many implications for communication research, policies, and plans. In the most fundamental sense, it is useful in gaining greater understanding of what the human communication process really means and how human values can be incorporated into the resource dimension.

But human values are expressed in both communication needs and rights, and since communication needs and rights are highly correlated, it is important to specify how they differ and what is added by incorporating both into the analytical framework. In general, the following characteristics can be assigned to communication needs and rights respectively:

COMMUNICATION NEEDS

Not Formal
Not Guaranteed
Functionally Oriented
Pragmatically Oriented
Basic and Changing
Human/Tech/Environmental
Level Oriented
Fulfilled by Tech/Human

COMMUNICATION RIGHTS

Usually Formal
Usually Guaranteed
Ideals Oriented
Morally Oriented
Basic and Relatively Stable
Human/Environmental
Level and "On-Off" Oriented
Granted by Law or Culture

By incorporating communication rights into the basic framework of the study dimensions of human morality, stability and equality are added to the analysis.

It is clear that the right to communicate is a rich and useful concept to the present study. Because the concept is newest and least understood of the N/R/R triad, it is necessary to specify some of the background of this evolving perspective.

The Right to Communicate efforts are little more than seven years old, yet they have drawn the interest and active participation of many nations. The Right to Communicate has been the topic of several conferences and the focus of several world projects and programs. Jean d'Arcy, then Director of Radio and Visual Services in the Office of Public Information at the United Nations in New York (1969), is credited with the initial concept. Since then, the Right to Communicate concept has been included in several Canadian Telecommunication studies; adopted as a long-range goal of the Speech Communication Association (SCA) (1972); a Unesco resolution, introduced by Sweden and adopted unanimously by the Communication Commission (1972); the theme for the International Broadcast Institute's Nicosia Meeting (1973); an informal working group topic at the IBI annual meeting in Mexico City (1974). It has been the major subject of the Asian Mass Communications Research and Information Center (AMIC) conference in Sri Lanka (1975); and the subject of an IBI working committee in Cologne, Germany (1975).

Related projects concerning the Right to Communicate included the Original Essays Project, which commissioned rights essays from persons around the world to make "contributions in their 'person capacities' . . . drawn from different cultural and geographic areas" (Richstad, *et al.*, 1975, p. 26). This effort has resulted in two books (Harms and Richstad, 1977; Harms, Richstad, and Kie, 1977).

In addition to these activities, there have been community policy dialogues held statewide in Hawaii, and most recently, right to communicate activities were evident in Unesco, Asian Mass Communication Information Center (AMIC), the East-West Communication Institute, and the International Broadcast Institute (now International Institute of Communication).

Although not an exhaustive history or description, the preceding paragraphs point out that the concept is emerging as an important component in the analytical framework for local, regional, and worldwide communication policy and planning. In this regard, it can be suggested the Right to Communicate may serve as a meta-policy, a balancing ethic (Martin, Byrne, Wedemeyer, 1977) or the basis for a new information order (Naesseland 1977; Unesco, 19C/93, 1976) which potentially serves all communication policy and planning activities. Communication rights provide a unique and fundamental dimension in the emerging needs/resources/rights frameworks.

APPROACHES TO BUILDING DATA BASES FOR COMMUNICATION POLICY AND PLANNING

Dialogue policy decisions, and plans are partially made on the basis of the information available to the participants. This basic activity comes early in the communication management process. It involves:

The collection of basic data and a systematic analysis of the country The production of an inventory of the present communication resources . . . the critical analysis of present communication policies, the analysis of the communication components in all aspects of the national development plans and programmes . . . the analysis of the constraints on communication developments and structures The definition of aims,

objectives of future communication policies, the analysis of the economic, social, cultural, educational relevance of the alternative communication strategies and structures . . . (and) the phasing of overall development of communication systems in a logical sequence matching the needs as assumed under present and future conditions as part of national development policy and planning." (Unesco No. 76, 1976, pp. 42-43)

This information assembling process should attempt to build a complete picture of communication needs, resources, and rights in the society. In a pragmatic sense, it is important that the information collected is directly related to the demographics and physical structures of the particular location under study. As a development goal, the data base should be the basis of all subsequent research studies. A Unesco proposal for international program of communication research (COM/MD/20.8) as early as 1971 pointed out that this sort of communication "inventory provides the static background for investigations into the dynamics of the system. Without such an overall map individual pieces of research will lose their perspectives and policy decisions will be based on inadequate evaluation of the status quo." Appended to the same Unesco document is a list of indicators required for an inventory of basic data for mass communication.* This suggested inventory, which could be broadened beyond mass communication, calls for qualitative and quantitative data "not limited to the conventional type of factual statistical data . . . (and recommends that) the inclusion of behavioral data as well as data describing the communication content" be included (Unesco, COM/MD/20, 1971, Annex 1).

Such an approach is necessary if a broad and encompassing foundation is to be established for effective management of societal communication resources to meet specified human needs and rights.

MANAGING COMMUNICATION RESOURCES TO MEET NEEDS AND RIGHTS

Central to communication policy and planning is the concept of communication management. The basic functions of management--organizing, planning, controlling, and decision making--are key to the creation and allocation of communication resources regardless of whether the system under consideration is an office, a corporation, school, nation, state, region, or world.

In Harms' treatment on the "emerging communication paradigm" reference is made to a communication management science and is directly related to communication resources (1976, p. 22). This suggests that the essential elements (resources) of a communication system--technological and human--are directly controllable.

The control of the communication system "is an eminent structural concern of communication policies. This involves not only general constraints on the communication system--political considerations, economic incentives, response to audience preferences, orientation towards social functions, but also an analysis of the values underlying decision making in the communication institutions themselves" (Unesco, No. 76, 1976, p. 35).

As in all control systems, the concepts of systems and cybernetics are central to understanding the process. In this situation, the system is regulated by the feedback process and its relationship to clearly defined system goals. The control cycle is influenced by externalities such as economics and politics but also has an internal organizational structure. In communication systems, the management and control relate to a cycle with the following elements (Van Gigch 1974, p. 353): the activity or process to be controlled, the sensor, the goal setter, the discriminator, the decision maker, and the effector.

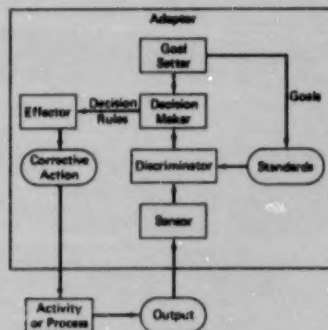
An example of the basic control cycle is shown in the following figure.

Although it is recognized that the policy and planning process of communication is an "open system," numerous conceptual advantages are gained by comparing an internally closed control cycle to the process. In this regard the sensor is the communication researcher or citizen who monitors (evaluates) the overall system performance. The standards or guidelines are policy statements that are developed in line with the goals of the communication system. In an open planning situation the goal setting and the guidelines (policies) are interactively determined by the collectively defined needs, rights, and available resources of the society. The goals are reference points from which overall systems performance can be measured. The discriminator uses these reference points to determine the performance of the system under analysis. This information (feedback) is passed to the decision maker, who uses the established system goals and standards (in the form of policies) to determine whether the effector should be activated to initiate corrective action in order to bring the system process back into alignment with the stated goals. Van Gigch (1974, p. 354) states that "another element (that is, a designer) can be added to the control cycle." It is the systems designer who supervises both the goal setter(s) and the

* Rahim (1976) has expanded this general list of indicators with more detail for communication planning.

decision-maker(s). In addition, the designer "organizes the whole system by formulating both the goals and the decision rules of the system." (emphasis added)

The Basic Control Cycle



Adapted from Joseph A. Litterer, *The Analysis of Organization*, p. 237.
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As previously mentioned, managing communication as a societal resource involves elements which are inherently less definable than elements in a closed system. In this sense, the policy and planning system is "open," and the basic control cycle has recognized limitations in its application. The closed system example can be viewed as a "model state" which is not attainable in "open" systems.

Van Gigch notes, "regulation in large complex systems such as at the level of a whole society or country cannot be easily conceptualized . . . (but) the notion of regulation in these systems consists of maintaining the system's responses within preestablished limits . . . (Management control refers to the) portion of the regulation which keeps the organization operating within established policies and guidelines" (1974, pp. 377-78). It is the function of communication policy makers, citizens, researchers, and planners to establish these guidelines and strategies in order to maximize the satisfaction of defined needs and rights within the constraints (if there are any) of the available or creatable communication resources.

TOWARD A POLICY AND PLANNING SCIENCE

The emerging communication paradigm is due, in part, to the crisis induced by the new information needs of policy makers and planners. It is the result of the increasing inability of traditional social science research methods and closed planning approaches to satisfy evolving societal needs and rights. The traditional boundaries of social science disciplines no longer serve the requirements of the new policy or planning scientist. Yehezkel Dror states:

Policy science must integrate knowledge from a variety of branches of knowledge into a supradiscipline focusing on public policy making. In particular, policy sciences is built upon behavioral sciences and analytical approaches, relying also on decision theory, general systems theory, management science, conflict theory, strategic analysis, systems engineering, and similar modern areas of study (1970, p. 138). (emphasis added)

The same can be said in regard to a planning science. That is, both draw from a wide variety of disciplines, and require a new synthesis of "pure" social science research with research that can be characterized as both "open" and as action-oriented.

Communication policy and planning sciences are clearly in early stages of evolution and transition. Harms has pointed out that "communication planning science lacks cohesion at this time (1976, p. 24). Some parts of the science exist as telecommunication planning, other parts as community planning, etc."

Policy and planning sciences are sensitive to the difficulties of "pure sciences" and its requirement for "value-free" investigation. In this regard, both sciences seek to further explore value implications, consistencies and alternatives.

Dror sets out some of the main paradigmatic innovations required of policy sciences (1970, p. 137). Although he does not specifically state it, a planning science also requires many, if not all, of the following innovations. These can be summarized as follows:

a breakdown of traditional boundaries of disciplines.

a bridging of the gap between pure and applied research.

a regard for experience as an important source of knowledge, augmenting conventional methods of research and study.

a sense of direction toward means and intermediate goals rather than absolute values--a movement toward "alternative futures" and their value content.

a new regard for time-sensitiveness, that is, regarding the present as a bridge between past and future.

an emphasis on metapolicies (and meta-planning) that is, policies on policies, modes of policy-making, analysis, policy-making systems, and policy strategies.

an emphasis toward "action" and involvement, and shift in methodology which "deviates significantly from normal science methodology."

In general, the emerging paradigm shift will be from one characterized by "crises" and "muddling through," to a systematic process of explicit, increasingly open, policy-making and planning. To accomplish this, new research methodologies and approaches need to be invented, or adapted that can account for (or anticipate) the emerging information needs of citizens, policy makers and planners. This report will specify some of the more promising, systematic, future-oriented approaches for supplying this emerging need. This methodological approach will draw its theoretical base from General Systems Theory and the philosophical systems of inquiry of Kant, Hezel, Locke, Leibniz, and Singer. Such a base is required before significant advances in policy and planning sciences can be expected.

SUMMARY

New communication policy and planning approaches are required as social and technological alternatives increase. The evolving structure must incorporate communication needs, rights, and resources into an increasingly "open" framework. Human communication needs and rights must be specified and prioritized in order to create or allocate communication resources.

The approach taken here attempts to balance policy and planning activities while incorporating political, socioeconomic, cultural, and psychological dimensions into the analysis. In short, a futures oriented policy and planning framework must be established that promotes research and public dialogue in the communication sector.

CHAPTER 2: GENERAL SYSTEMS THEORY AND COMMUNICATION POLICY AND PLANNING

INTRODUCTION

General Systems Theory (GST) provides one strong, theoretical base for a comprehensive approach to communication policies and planning. Applied General Systems Theory, or the systems approach, can reduce the unnecessary and extensive overlap of policy making, planning, system building, and system operation.

It should be pointed out, however, that this view is not shared by all persons in the communication sector. In a 1974 Unesco seminar on the Role and Training of Communication Planners differing opinions were expressed in regard to the systems approach. The seminar report stated (COM74/CONF. 713, 1975, p. 9):

While some (people) regard such an approach as key to effective integrated planning, others argue that any attempt to apply a scientific systems approach will do injustice to the complexity of the situation, especially political and human elements, and be more likely to confound than to clarify.

The approach and viewpoint of this report is in line with those who favor the application of GST to the problems of communication policy and planning. The position taken here is that failure to incorporate GST into the policy and planning process leads to reduced abilities in dealing with the complexity of the problem and promotes resource wastage. This approach treats the social system as a whole, having as one of its subsystems the communication system. It in turn is composed of smaller subsystems.

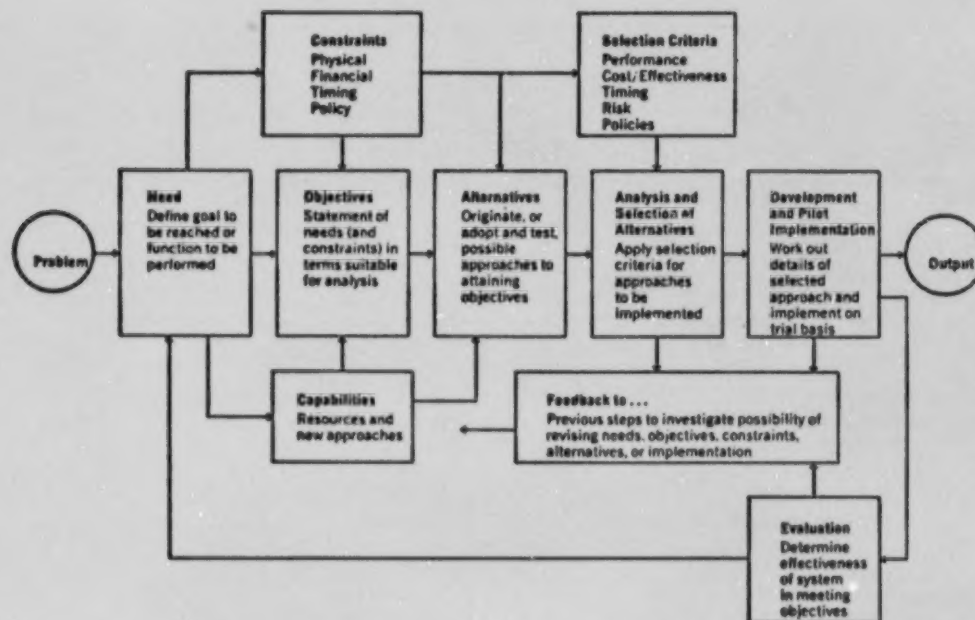
A system has been defined as a "set of objects together with relationships between the objects and between their attributes" (Hall 1975, p. 52). Ackoff broadly defines a system as "any entity, conceptual or physical, which consists of interdependent parts" (1969, p. 330). Either definition serves the purposes of this report.

In GST, the relationship of parts must be taken together, that is, "a structure of wholes" (Angyal 1969, p. 17). General systems theory concerns the problems of wholeness and organized complexity. It approaches problems holistically, yet provides a framework for breaking the problem into smaller, more manageable, components. These subsystems can be studied without losing their inherent relationships to the whole. Because GST provides a framework for complex problem solving, it can be viewed as a "new kind of scientific method" capable of providing a foundation for the emerging policy and planning activities (Van Gigch, 1974).

The scientific method has served well in helping to explain physical problems but has some shortcomings when dealing with the dynamic processes involving life, evolution, adaptation, and interaction.

GST provides a new framework for conceptualizing and problem solving which incorporates both physical and biological realms, and provides a foundation for methods designed to deal with less defined variables such as human values and judgments. Van Gigch (1974) states, "systems approach is for the most part involved with designing organizations--man-made, goal-oriented systems that serve mankind . . . (GST) seeks to wed behavioral with strictly mechanistic views, and to consider the organization as an integrated whole, whose goal is to achieve overall system effectiveness while harmonizing the conflicting objectives of its components." (emphasis mine)

The systems approach then, is a general theoretical framework for problem solving. This involves the problem, resource inputs, an internal process, an output (solution), and evaluation. The general process is shown in the following diagram (International City Management Association, 1972, p. 2):



This integrated approach is both necessary and desirable when considering such complex problems as the plans and policies that shape societal communication. As these policy and planning sciences evolve it is important to underpin them with a strong theoretical foundation. The origin and development of this relatively recent meta-theory is provided in the following section.

HISTORY AND EVOLUTION OF GST

Earliest general systems "thinking" dates back to the late 1700's in the writings of George Wilhelm Friedrich Hegel. Hegel contributed some of the basic underpinnings of General Systems Theory. Among them are:

The whole is more than the sum of the parts.

The whole determines the nature of the parts.

The parts cannot be understood if considered in isolation from the whole.

The parts are dynamically interrelated or interdependent.

Around 1930, GST was referred to as a "new logic" that could embrace living as well as non-living systems (Van Gigch, 1974, p. 50). Although writings can be found that precede the fifties, General Systems Theory is said

to have its origin, as a discipline, in 1954. Early GST writings were contributed by Von Bertalanffy, Boulding, Rapoport, Ashby, Wiener and others.* The focus of Von Bertalanffy's early writings was on living (open) systems. His work "set the foundation for the set of approaches, theories, applications, and methodologies which are collectively called general systems theory" (Rubin and Kim, 1975). Kenneth Boulding contributed significantly to the development of the theory in his article, "General Systems Theory, the Skeleton of Science" (1956). This work concerns the problem of over-specializations of many disciplines and proposes that certain general concepts be drawn out of the various disciplines and that these common "phenomena" be used to construct general theoretical models. It is this framework, or structure, that "hang the flesh and blood of particular disciplines."

SYSTEMS AND SYSTEM CONCEPTS

Before applying GST to problem solving, it is important to know and understand the basic concepts used for characterizing systems. Usually the following terms are associated with improving or designing a basic system (Van Gigch, 1974):

Elements: Elements are components of each system. In many cases they are considered systems in themselves, (that is, sub-systems of larger systems). In a network analysis application these are sometimes referred to as information "nodes."

Conversion Process: That which goes on within the system. Usually this process takes "inputs" and applies some process of change and produces "outputs." The unknown, or unspecified conversion process is referred to as a process that operates within a "black box."

Inputs and/or Resources: Usually inputs and resources are slightly different. In this regard, system resources are applied in the conversion process; inputs, on the other hand, go into the system to be converted.

Outputs: The result of the conversion process within a given system. These are counted as the outcomes or benefits of the system. They can also be simultaneously considered inputs into other systems.

Environment: The environment of the system is defined by its boundaries (parameters). This specification is essential to the determination of the jurisdiction of the systems designer or analyst (that is, it is considered external to the system under design or study).

Purpose and Function: The purpose of a given system is determined by its relationship with other systems (sub-and meta-). It is important to specify and understand the relationship within the context of a hierarchy

A few classic references in regard to GST include:

ACKOFF, R. L., "Systems, Organizations, and Interdisciplinary Research," General Systems, Vol. 5, 1960.
ASHBY, W. Ross, An Introduction to Cybernetics, NY: Wiley, 1956.

BEER, Stafford, Cybernetics and Management, London: University Press, 1959.

BERTALANFFY, Ludwig von, and Anatol RAPOPORT (eds.) General Systems, Washington, DC: Society for General Systems Research, 1956.

BOULDING, Kenneth E., "General Systems Theory--the Skeleton of Science," Management Science, Vol. 2, 1956.

CHURCHMAN, C. West, The Systems Approach, NY: Delacorte, 1968.

EMORY, F. E. (ed.), Systems Thinking, London: Penguin Books, 1969

KOEHLER, W., "Closed and Open Systems," Systems Thinking, F. E. EMORY, London: Penguin Books, 1969.

MCCLELLAND, Charles A., "General Systems and the Social Sciences," ETC, Vol. 18, 1962.

MARUYAMA, Magorah, "The Second Cybernetics: Deviation Amplifying Mutual Causal Processes," American Scientist, Vol. 51, 1963.

WEINER, Norbert, The Human Use of Human Beings, Garden City, NY: Doubleday, 1954.

of systems. The purpose or function can also be considered the regulating or reference point of the system under study.

Attributes: The specific priorities of systems or sub-systems can be "quantity-like or quality-like." Attributes are sometimes used as measures of effectiveness in system evaluation and are the basis for control decisions.

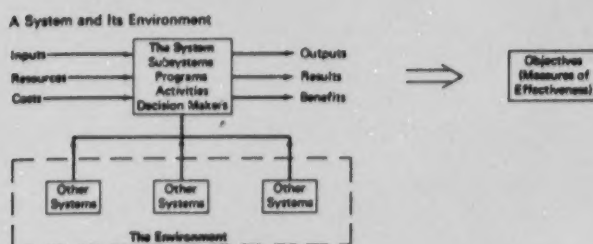
Goals and Objectives: Goals are end-points or purposes. They set criteria for separating and defining systems and are also essential to evaluation. Objectives are usually thought of as steps (sub-goals) toward attaining goals.

Management, Agents and Decision Makers: Those that are responsible for action and decisions moving toward the system goal are policy makers, planners, or managers of a system.

Structure: The relationships that bind the sub-systems together form the structure. Structure, for the most part, determines the efficiency and effectiveness of the system. It is defined by the links between elements in a system. These links usually define the strength of the relationships among the elements.

States and Flows: The system "state" is defined by the properties of the elements which may be sub-systems at a given point in time. These changes from state to state constitute the system "flow." A systems "behavior" can be characterized by determining the systems "states" over time.

The following diagram is useful in clarifying the relationship of these basic concepts (Van Gigh, 1974, p. 13):



APPLIED SYSTEMS APPROACH TO PROBLEM ANALYSIS

A number of advantages accrue when applying general systems theory to the process of communication policy and planning. In taking this approach, it becomes possible to systematically specify alternatives and, in many cases, arrive at broader, more human-centered solutions with improved efficiency and greater economy. This advantage is important in meeting defined needs and rights with scarce (or limited) resources. The application of the systems approach, as pointed out by Unesco (No. 75, 1975, p. 46) is "especially relevant in the developing world, where low-cost, high-yield solutions have to be found."

The systems approach can be regarded as having many diverse applications. It can be considered:

A methodology of design: "systems must be planned and not just be allowed to 'happen'."

A common conceptual framework: "a system of systems concepts."

A new kind of scientific method: "a new kind of thinking that is applicable to the realms of the biological and the behavioral."

A theory of organizations: "explained in terms of "systematic" concepts such as cybernetics, open and closed loops, self-regulating, equilibrium, growth It complements other approaches."

A method related to systems engineering, operations research, cost-effectiveness: "all draw from a common source, and the literature of these fields is intimately related to that of Systems Analysis."

Applied General Systems Theory: "investigates the concepts, methods, and knowledge pertaining to the fields of systems and systems thinking."

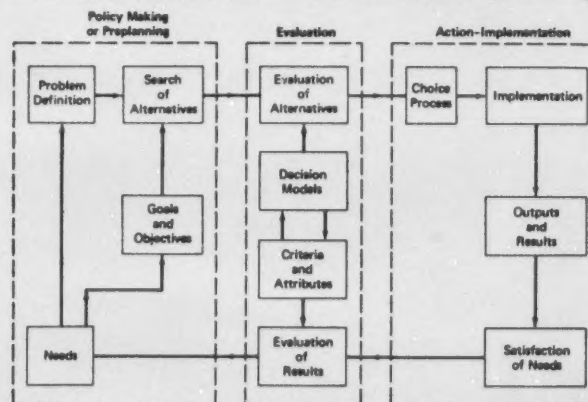
It is in these regards that General Systems Theory's direct application to communication policy and planning is most clear. As a Methodology of Design, GST can be applied to both hardware and software development. As a common conceptual framework, GST provides a structure for advancing dialogue among citizens, policy makers, planners, and researchers. As a new kind of scientific method, GST promotes complex problem solving by providing a mechanism for making tradeoffs between human need and rights and technological demands. As a theory of organizations, GST provides a cybernetic feedback framework for the design, regulation, and balancing of internal elements. Finally, as a method of applied problem solving and engineering, GST relates concepts and methods in order to solve complex problems in a more orderly, efficient manner.

In summary, General Systems Theory provides a significant foundation and practical approach to communication policy and planning problems.

SYSTEMS DESIGN AND DECISION MAKING

The process of moving from defined needs and rights to the systematic creation and employment of resources involves many decisions and tradeoffs. In this regard, the systems approach is "a decision-making process which is used to design systems" (Van Gigch 1974, p. 57). In any system, design decisions involve making choices among competing alternatives. These alternatives are different strategies by which the desired goals and objectives can be met. Obviously, each must be examined and evaluated from the standpoint of the overall system goal. Decision criteria must be clearly established and applied. The criteria and system used to make the decision is sometimes referred to as a decision model. The criteria are established and reviewed in light of overall and ongoing system performance or output. This system review is considered the "evaluation stage" of the system design process (Van Gigch 1974, p. 72).

The Decision-Making Cycle Broken Down into the Three Phases of Systems Design



Here the decision making cycle breaks down into three basic phrases: the policy making or preplanning stage; the evaluation stage; and the action-implementation stage.

This report will primarily address the first phase. It should not be concluded, however, that the remaining two phases are secondary in nature, only that policy making and preplanning are central to the theme of this report. The first stage subdivides into three steps which can be discussed in greater detail.

Step One: Problem Definition: Needs are central to the design of any system. In this regard, it is important to properly (and collectively) define the problems at hand. This includes needs, parameters, clients, etc. The final problem statement must include:

The recipient whose needs shall be met.

The needs to be met.

The statement of scope, to explain the extent to which needs will be satisfied.

The agents--designers, planners, decision makers--who will be involved in the project, with a listing of specific interests in the project.

The methods--a general description of the methods which will be used to solve the problem.

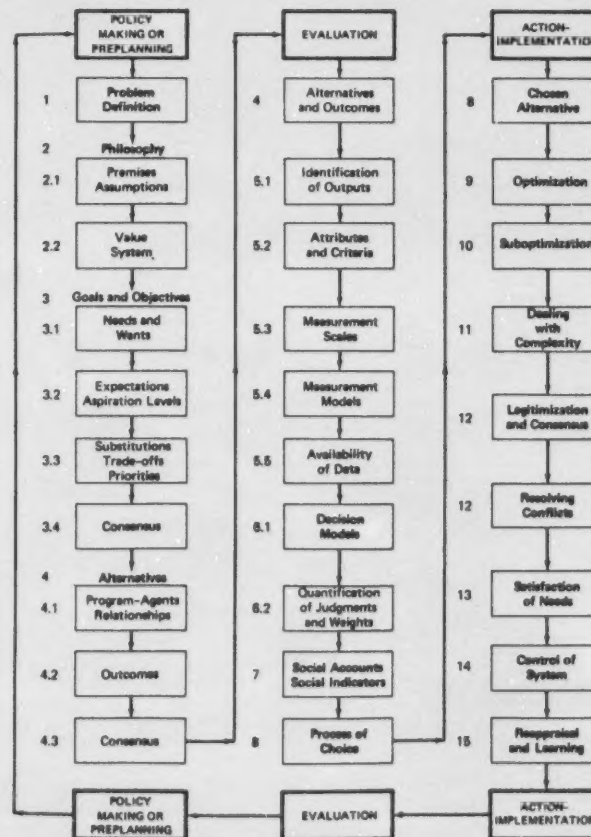
A disclaimer--to delimit the hopes of those who think that the system design will solve everything (Van Gigch 1974, p. 72).

Clearly, the state of policy making or preplanning is directly related to the establishment of system boundaries. It is in stage one that a "comparison must be made between available resources and needs" (Van Gigch 1974, p. 72).

Step Two: General Statement of Philosophy: This step involves a mutually agreed upon statement of purpose between the planner and the client. This understanding is essential if subsequent implementation and evaluation of the system is to take place. This requires knowledge of the planners' and the clients' premises and assumptions; and knowledge of their respective value system (Van Gigch 1974, p. 74).

This sort of understanding will assist the system planner in formulating realistic plans that are "responsible, sensitive, and responsive to the needs of those they serve."

Step Three: Setting Goals and Objectives: This step involves all designers, agents, and clients in the formulation of the goals and objectives of the system being designed. This process requires ascertainment of needs and wants; expectations and aspiration levels; substitutions, tradeoffs, and priorities; and consensus (Van Gigch 1974, p. 74).



It is necessary in moving toward defining these goals and objectives, that a "process of convergence" take place. In this regard, it is essential that a wide spectrum of interests are used as inputs into the process in order that the final goal statement be a "viable composite to which all can subscribe." (More will be said in this regard to consensus in the discussion of Delphi in this part.)

As previously mentioned, although the last two phases (evaluation and action-implementation) will not be described in detail in this report, it is important to note that none of the stages are any less important or independent of the others. The detailed relationship/interaction among the three stages is depicted in Figure 6 (Van Gigch 1974, p. 73).

It is clear that the steps of a general system design parallel the steps of policy and planning. It is this overlap nature that establishes GST as a strong theoretical base to the otherwise foundationless process.

As stressed throughout this report, the process of moving from collectively defined needs and rights to commonly agreed upon goals is central to the process of communication policy and planning. Moving toward the desired goals most always involves some elements of conflict. Methods of conflict resolution in the systems approach involve compromise, substitution, and tradeoffs. When confronted with a conflict situation, the decision maker must not only know the needs and rights of the client population, but also must know the priority and weight associated with each. By knowing these priorities, a series of tradeoffs (that is, more important needs and rights, can be substituted for less important) can be made in order to move toward the stated goals and objectives.

This process of convergence of needs, expectation, and tradeoffs toward goals and objectives is shown in Figure 7 (Van Gigch 1974, p. 59).

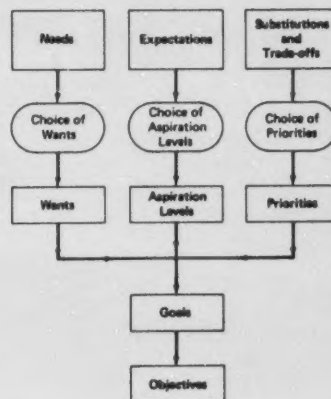


FIGURE 7: THE CONVERGENCE OF NEEDS, EXPECTATIONS, AND TRADEOFFS TO GOALS AND OBJECTIVES

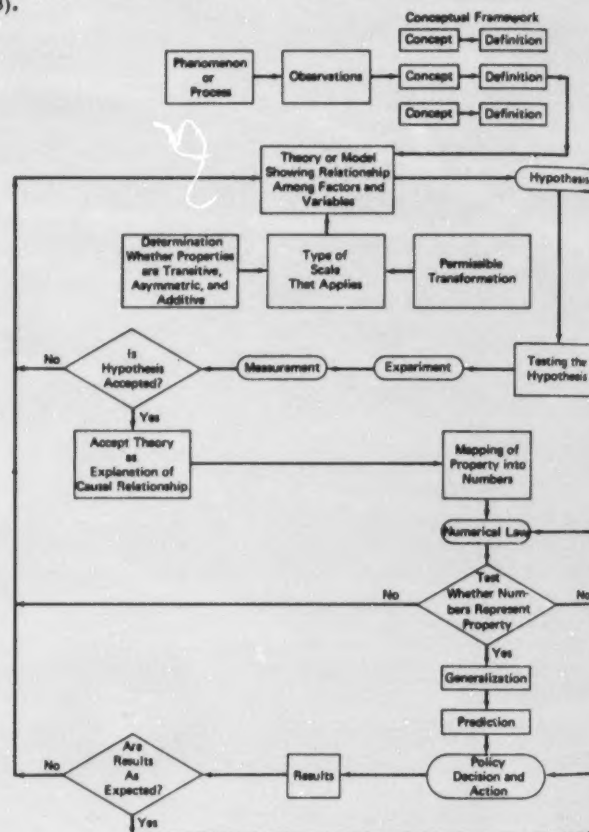
Figure 7 serves equally well as a general policy model. In such an application, the needs must be made known, the priorities of these needs must be determined, and a series of tradeoffs and substitutions must be made. This process assists in determining long-term, well-defined system goals which are subsequently the basis for specific policy formulation. The system goals are then translated into functional plans. Here the decision making process, the systems design process, and the policy making process are overlapping in nature.

SYSTEMS APPROACH TO POLICY DECISIONS AND ACTION

Once it is recognized that all policy and planning activities involve choosing among alternatives and that this decision cycle is activated by the urge to satisfy needs and rights, the decision system used in making these choices takes on a new importance. The cycle generally follows the stages of conventional scientific inquiry,

that is, observations, definition of terms, hypotheses, theory or model of relationships, test/predictions, decision, and actions. This cycle involves a loop feedback process. In addition to this internal information cycle, external influences help maintain the system's balance. In a policy decision situation, this process draws upon theory or models of relationships to predict particular outcomes of choices. This policy decision then evokes action and a subsequent evaluation of the results. The evaluation data serves as input (feedback) into the theory or model subsystem and the cycle is repeated. Figure 8 clarifies the intricate relationships and flows of the cycle (Van Gigh 1974, p. 138).

FIGURE 8: THE POLICY
VALIDATION CYCLE:
A SYSTEMS APPROACH TO
POLICY DECISIONS AND ACTION



In initiating the cycle, early policy decisions can be made based upon less certain causal relationships of the various factors involved. By employing this cybernetics approach, the precision of decision models (and theories) should increase as a function of the number of policy cycles. As a result, stronger policy decisions based upon stronger predictions can ultimately be made.

If the theory or model does not increase precision (in prediction) as a function of the number of cycles, a "crisis" situation may arise. Depending upon the severity of the crisis, new models or theories may be advanced. On a larger scale, this "fit between theory and nature" is described by Kuhn in The Structure of Scientific Revolution. He states:

Scientific revolutions are inaugurated by a growing sense . . . that an existing paradigm has ceased to function adequately in the exploration of an aspect of nature . . . the sense of malfunction that can lead to crisis is a prerequisite to revolution (1962, p. 92).

The parallel between the policy validation cycle and the process of scientific inquiry is clear. Abstract models, theories, and paradigms (both formal and informal) are used to make predictions and decisions about real world problems. These predictions are subsequently validated or rejected in light of specific data.

* von Bertalanffy states, "a system is closed if no materials enter or leave it; it is open if there is import and export and, therefore, change of the components. Living systems are open systems . . ." (1969, p. 70).

More will be said in this regard in the Cross Impact chapter of this part. Generally, the cross impact analysis approach provides a relatively simple, general-purpose model kit that permits the construction of at least a rudimentary policy and planning model (Cf. Helmer 1975, p. 8).

THE MORALITY OF SYSTEMS DESIGN

Simply stated, to design systems is to shape human behavior. Obviously, there is no such thing as a perfectly designed system. Elements of the designer's worldview will be incorporated in the final design (Singer's philosophic position) resulting in positive and negative aspects within any system. The inherent tradeoffs involved with all design decisions are made in order to maximize the rewards of particular value systems. It is important to be cognizant of biases of particular value systems in order to design or evaluate any given system. There is probably no inherently "good" or "bad" system design; however, specific system designs may more closely parallel the needs and rights of the ultimate users than others. The values of a particular designer(s) places priorities within any system design. For example, these individuals may hold such values as group interest over individual interests, or profits over environmental concerns. A communication systems designer could hold higher priorities for the needs of the state or a multi-national corporation over the needs for individual privacy, lower-usage costs, or accessibility. The list could go on, but the point is that the final system design reflects the bias of a particular set of values.

To determine the morality of a system's design is to evaluate the effect of the planner's intervention upon those for whom the plan was intended. It involves a consideration of the following: a science of values, the ethics of spillover effects, the ethics of causing change, and the ethics of goals.

The concern for values (expressed in communication needs and rights) is most difficult to express in "scientific" terms. An example of one treatment is included in chapter six.

The ethics of the spillover concerns the internal changes of a particular system subsequent to its association with another system. Direct broadcast communication satellite systems have brought the consideration to the forefront. Systems are not stand-alone entities; changes, or redesigns of one system, affect the environment or inputs of another system(s).

When attempting optimization of one subsystem, the change can and often does, suboptimize another system. Designers who are able to take the "total" system (a system of systems) and its environment into account have a better chance of designing structures that have "positive" (intended) effects when implemented.

Finally, in regard to the ethics of change, change does not necessarily imply negative manipulation or unwanted control. Like all organizational activities, change can be applied in a negative manner. It is the systems designer, closed to external inputs, that has the potential of misusing the power of change. When promoting change it is important to know the values of the people within the system being specified. It is for this reason that citizen groups and individuals have a legitimate reason to demand input into the design and decision making process. These inputs should be strongly considered when ascertaining the goals of any particular system. The goals of a particular system design should be "in-line" with the needs, rights, and resources of the group(s) to be affected.

SUMMARY

It has been posited that General Systems Theory provides a strong theoretical base for communication policy and planning. In this sense, the systems approach provides a framework for obtaining and validating knowledge about the environment in which the policies and plans are to be made. As in the scientific mode of inquiry, the systems approach emphasizes prediction by models that represent the "real world." By allowing for the concept of cybernetics, the feedback process serves in "fine tuning" a good design or ultimately destroying the poor one.

The framework for GST can be summarized as follows:

1. There is a general tendency towards integration in the sciences, natural and social sciences.
2. Such integration seems to be centered in a general theory of systems.
3. Such theory may be an important means for aiming at exact theory in the non-physical fields of science.
4. Developing unifying principles running "vertically" through the universes of the individual sciences, this theory brings us nearer to the goal of the unity of science.
5. This can lead to a much-needed integration in scientific education (von Bertalanffy 1975, pp. 8-9).

Finally, GST provides a foundation on which to build other theories and make predictions.

CHAPTER 3: FUTURES RESEARCH AND ITS RELATIONSHIP TO COMMUNICATION POLICY AND PLANNING

INTRODUCTION

Futures research as an organized, methodological activity is only about ten years old. Because it investigates longer-term directions of social change, it approaches problems with a slightly different perspective than previous research methods. Futures research stresses interdisciplinary problem solving that is both anticipatory and pragmatic. It treats problems holistically, as in the general systems approach, with the intention of improving the decision making and problem solving process. The products of such research activities are important in providing future-oriented information to the public as well as those directly charged with policy and planning responsibilities. In this regard, Yehezkel Dror has set out specific guidelines for policy-oriented futures studies. They are:

Policy-oriented futures study should explicitly relate alternative futures to present decision (subject to guideline number 4).

Policy-oriented futures study should deal with matters of actual or potential policy concern.

Policy-oriented futures study should engage in "look out," that is, identification of important policy issues, which are not recognized as such because of unawareness of possible developments and their significance.

Policy-oriented futures studies should deal with alternative futures of critical issues even when no relation of alternative futures to present decisions can be identified.

Policy-oriented futures studies should engage in exploration of alternative value features.

Policy-oriented futures studies should try to develop alternative comprehensive future covering all social institutions at least in outline.

Policy-oriented futures studies must not only be of high quality, but should be recognizable as of high quality.

Policy-oriented futures studies must be easy to communicate to policymakers and should meet the conditions of access to policymaking.

Policy-oriented futures studies should adjust their methodologies to the needs of policymaking. This includes, in particular: (a) an "Alternative Futures" approach; (b) attention to cross-impacts and interdependencies between the alternative futures of different social institutions; (c) emphasis on identification of future-shaping variables; (d) examination of future developments influencing identity of variables which can serve as future policy instruments; (e) strict explication of assumptions and rigorous value-sensitivity testing.

Policy-oriented futures studies should explicitly deal with alternative futures of political feasibility.

Policy-oriented futures studies require formats permitting concise presentation of findings for policy-making uses.

Policy-oriented futures study should participate, as part of policy sciences, in the study of policymaking-system characteristics necessary and sufficient to make good futures studies desired and used by the policymaking system.

In particular, policy-oriented futures study should explore alternative policymaking-system futures and identify relevant future-shaping variables.

Policy-oriented futures studies should carefully study the limitations and dangers (such as self-realizing effects) of even excellent futures studies as an input into policymaking, explicate these limitations and dangers, and search for ways to reduce them.

Policy-oriented futures studies should pay much attention to the problems of interface between futures studies and policymaking, including relevant features of the policymaking system; of the communication channels between the policymaking system and futures studies; and of the content, methodology, organization and structure of futures studies themselves. This should be done in close relation with policy sciences as a whole (Dror 1970, p. 165).

These guidelines have important operational implications for the content and methodology of futures research. In a broad sense they set out a framework to bridge the gap between the established methodologies of futures research and the application area of communication policy and planning.

Herman Kahn and Anthony Wiener have also contributed to this interfacing activity in the following statement of objectives for future-oriented policy research. These objectives are:

To stimulate and stretch the imagination and improve the perspective.

To clarify, define, name, expound, and argue major issues.

To design and study alternative policy "packages" and contexts.

To create propaedeutic and heuristic expositions, methodologies, paradigms, and frameworks.

To improve intellectual communication and cooperation, particularly by the use of historical analogies, scenarios, metaphors, analytic models, precise concepts, and suitable language.

To increase the ability to identify new patterns and crises and to understand their character and significance.

To furnish specific knowledge and to generate and document conclusions, recommendations, and suggestions.

To clarify currently realistic policy choices, with emphasis on those that retain efficiency and flexibility over a broad range of contingencies.

To improve the "administrative" ability of decisionmakers and their staffs to react appropriately to the new and unfamiliar (1967, pp. 398-399).

Although these guidelines and objectives are directly concerned with policy applications, they hold important implications for the planning process in general. In this broader regard, the statements can be used to establish guidelines for new policy and planning research activities.

In the past ten years, many futures research institutes have emerged to serve this growing need for policy and planning information. Examples of such institutes include the Center for Futures Research at the University of Southern California (U.S.C.), and the Institutes for the Future (IFF) in Menlo Park, California, and Middletown, Connecticut. Other Futures Centers can be found in various locations such as West Berlin, Prague, London, Moscow, Rome, Washington, Brazil, and Caracas. These institutions concentrate on horizons of from five to fifty years. In the case of the Center for Futures Research (USC) the research program provides:

Forecasts and technology assessments that form some basis for assumptions about alternative future possibilities;

Direct assistance in the design and enhancement of planning processes that allow an organization to formulate and implement long-range strategies; and

The invention of new methodologies and information systems that can help structure their thinking about the future.*

These activities support private and public information needs by supplying systematic and comprehensive long-range studies.

A second example providing similar research support is the Institute for the Future. IFF's aim is:

To enlarge existing understanding concerning technological, environmental, and societal changes in their long-range consequences; to develop new methodology to carry on such tasks; to make available without discrimination the results of such research and scientific advances to the public; and to serve as an educational and training center for selected persons from business, government, foundations, and universities with respect to such research activities.**

In both examples, CFR and IFF, particular emphasis is placed upon the development of forecasting methods and the application of these methods to specific problems. In addition to these general areas, IFF is specifically concerned with the assessment of future consequences of public policy choices, action planning, and the identification of critical societal issues.

It is clear that the emphasis of these institutes is on providing research that is operationally meaningful (in the form of information and analysis) to those charged with the responsibilities of long-range policies and plans.

Olaf Helmer, Harold Quinton Professor of Futures Research at the Center for Futures Research, points out that "Futures research is a branch of operations research The main characteristic which differentiates futures research from standard operational research is that its objective is to improve decision making in the case of long-range plans" (1975, p. 3). It is precisely this difference that makes futures research an important tool for communication policy and planning.

The incorporation of anticipatory mechanisms in operations research facilitates present-day problem solving without simultaneously creating larger, perhaps less solvable, future problems.

THE EVOLUTION OF FUTURES RESEARCH

There have always been attempts to predict and control the future. The "futures movement" as an organized activity is less than twenty years old. It was initiated in Europe by Bertrand de Jouvenel and Dennis Gabor. De Jouvenel was then leader of the "Futuribles" Group and Gabor was author of the book, Inventing the Future.

The first two efforts in the United States were Daniel Bell's "Commission on the Year 2000" and the initial Rand Corporation's public statement of Gordon and Helmer technological forecast study utilizing the Delphi Technique.

The last decade of futures research has produced a great assortment of techniques for forecasting and

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| * Specific CFR Reports concerning Communication Policy and Planning include:
Nanus, Burt, Michael Wooten, and Harold Borko. <u>The Social Implications of the Use of Computers Across National Boundaries</u> , February 1973.
Gray, Paul. <u>Prospect and Realities of Telecommunication/Transportation Tradeoffs</u> , September 1973.
Nilles, Jack M., Frederick R. Carlson, Paul Gray, and Gerhard Hameman. <u>Telecommunication Substitutes for Urban Transportation</u> , August 1974.
Lopez, David A. and Paul Gray. <u>Case Study of Telecommunications/Transportation Tradeoffs</u> , September 1974.
Nanus, Burt and Herbert Dordick. <u>The Future of Network Information Services</u> , April 1976. |
| ** Some specific IFF communication reports include:
<u>Group Communication Through Computers, I, II, III.</u>
<u>Toward Understanding the Social Impact of Computers.</u>
<u>Potential Market Demands for Two-way Information Services to the Home.</u>
<u>The Future of the Telephone Industry 1970-1985.</u>
<u>A Framework for Community Development Action Planning, I, II.</u>
<u>The Future of Newsprint, 1970-2000.</u>
<u>Toward a Framework for Communication Policy Planning.</u> |

long-range planning. In addition to these activities, several journals are specifically addressed to future-oriented problems, and hundreds of general futures articles and books can be found.* Each year there are international symposia and conferences which deal directly with "designing the future." Increasingly universities are offering courses that address alternative futures of practically any subject area. These activities indicate that the study of the future has become an "idea in good currency."

As stated from this rather short but prolific history, there have emerged some substantial methodological futures research techniques and applications. Continued developmental work is required to further refine and apply these methods to substantive long-range policy and planning efforts. Such work must not just apply these new methods, but underpin them with a more substantial theoretical base. In this regard the most valuable contribution to knowledge concerning these methodological foundations should be closely tied to pragmatic applications. The emerging areas of communication policy and planning can benefit and contribute much to this developmental process. Futures research in combination with the general system design process can render obsolete the current "incremental" and "crisis-oriented" approach to communication planning.

Futures research techniques provide frameworks for dialogue, forecasting, and long-range planning. Amara (1975, p. 1) suggests that futures research aids in the identification and organization of assumptions about the future, and the systematic exploration and improvement of the understanding of long-term consequences of developments and choices.

These statements emphasize pragmatic application, the understanding of values and assumptions, collective perceptions, likely developments, and future consequences of present day options. In this sense, the primary purpose of contemporary futures research is "not to predict the future, but rather to make explicit the assumptions we hold about it; to identify future alternatives; to trace the possible consequences of developments; and ultimately, to try to shape and guide the future to meet our needs" (Amara 1975, p. 1).

Futures research has evolved to the point of providing a basic aid to thinking; although these approaches and research techniques are in the early stages of development, they are particularly promising in the application areas of communication policy and planning.

SHORT-AND LONG-TERM PLANNING

Planning, by definition, is future-oriented. This simple statement is central to understanding how futures research methodologies apply to policy and planning problems. Failure to assume a future-oriented posture "can lead to difficulty in anticipating prospective changes sufficiently far into the future to improve long-range decisions and avoid either premature obsolescence or unexpected difficulties" (Enzer 1970, p. 18).

The time required for these considerations vary. Short-term plans and actions must be weighed against long-term consequences and goals. Here, short-term planning refers to plans for less than five years. Long-term planning usually refers to five to thirty years. The following rationale for these time frames has been advanced by Helmer (1973, p. 2):

Planning for shorter periods than five years usually can be based upon reasonably straight-forward extrapolation from the past, whereas diminishing marginal returns tend to nullify the values of extending the planning interval beyond thirty years.

Increasingly, short-term communication plans must be made with an eye toward the longer term. This is due to the scale and cost of most societal communication decisions. Examples include satellites that have life spans of 7-10 years, and undersea or underground coaxial cables that carry with them a 20-year economic commitment. This longer-term emphasis has been taken by the Australian Post Office (APO) (Unesco 1974, p. 12). APO has undertaken a number of studies that employ various futures research techniques.† APO themes are:

* Examples include:
The Futurist, World Future Society
Futures
Technological Forecasting and Social Change

† Some selected examples include:
Telecom 2000
Delphi Forecasting Study National Telecommunication Planning
Expert Opinion Forecasts of Costs of Future Technology
Open Planning for Telecommunications
Forecasting Methodologies; Telephones in Australia

the need to understand and predict society's communication needs, and to exploit both technology and other current resources to meet them;

the emergence of a powerful knowledge industry, and the significance of the linking, for example, of communication facilities to a powerful computer base, thus allowing the emergence, as a "spin off," of many services for which the communication facilities are merely the channel, not the source;

the role of the telecommunication engineer and planner, which is to explain and display possible technological resources and alternatives, so that others responsible for the identifying needs and selecting as to priority between them can make appropriate choices. (emphasis added)

It can be expected that other nations will follow Australia's lead in forecasting and planning communication futures.

PREDICTION VERSUS FORECASTS

Application of futures research techniques to policy and planning requires a clear distinction between what is meant by forecasting, and what is meant by prediction. Prediction posits some future event with certainty; that is, it is a statement that carries with it a probability of one. Forecasting, on the other hand, is a probabilistic statement that carries an attached probability almost always less than one. Forecasts are usually posited in conditional form; for example, if some event (x) occurs, then the probability of another event (y) occurring is .25. This distinction is particularly important for researchers, policy makers, and planners who are interested in the "causal connection between potential future developments" (Helmer 1973, p. 1). These developments are classified under "trends" and "events." Policies and plans are assumed to directly affect these trend values and event probabilities. These distinctions will be elaborated in the chapters concerning Delphi and cross impact analysis.

FUTURES RESEARCH AND SYSTEMS ANALYSIS

There are many similarities between the elements and approach of systems analysis and futures research. One important similarity is that both are "relatively insensitive to the issues being addressed" (Enzer 1970, p. 18). That is, both are relatively neutral structures of analysis and can be applied to widely varying problems.

The steps of both systems analysis and futures analysis overlap and concern those outlined in the following: (Enzer 1970, p. 19)

Issue-Oriented Information

- Objectives
- Scope
- Factors influencing the issue (values, motivations)
- Information needs (indicators, measures of effectiveness, credibility)
- Current Status

Prospective Developments

- Major events
- Event-oriented information (likelihood, time period, importance, desirability)
- Event interactions

Potential Actions

- Alternatives
- Anticipated effect on events

Alternative Futures

- Potential outcomes (likelihood, time period)
- Assessment of outcomes (indicators, measures of effectiveness, credibility)
- Most important alternatives and actions

The difference between these two types of analysis is that the futures approach stresses probabilities and multiple alternatives in a longer term perspective. Consequently, the information required in the analysis and the specific methodological approaches required to supply them shifts in time frame only. Futures analysis is "concerned with forecasting the developments relevant to the issue" (Enzer 1970, p. 18). These forecasts are

then regarded as "data" from which systematic problem solving can be achieved.

METHODOLOGIES OF FUTURES RESEARCH

A great assortment of future research technique exists, but these approaches fall into two methodological categories, quantitative and qualitative. The quantitative approaches are usually based on historical trends, or time-series data with specified internal rules. The predictions of future trend values are predicated on the established rules in regard to the direction and magnitude of these captured data points. Probably the best-known technique is regression analysis, which reduces data into "best-fit" linear equations, and subsequent predictions are made from the equations. Moving averages and exponential smoothing are other examples of quantitative forecasting methods.*

The qualitative methodologies are much more subjective or "judgment-oriented." They are applied to situations as in policy and planning where considerable uncertainty exists in regard to the problem area. The aim of qualitative methodologies is to "forecast changes in a basic pattern as well as the pattern itself" (Wheelwright 1973, p. 5). This type of methodology is often used to predict significant shifts in particular historical patterns.

This type of forecasting requires that historical data be analyzed and that key indicators be specified. For many problems this requires the collection of "expert" opinion to forecast the significant "turning points" in established trends. The systematic analysis of "expert" opinion supplies probabilistic estimates in this regard.

INTUITIVE FORECASTING

Probably the best-known qualitative method involving intuitive forecasting is Delphi. The conventional Delphi technique involves the iterative polling of experts (usually 2-3 rounds) with anonymous feedback. A more precise description is provided by Olaf Helmer, one of the technique's co-inventors:

The Delphi Technique is a method for obtaining a consensus of opinion from a panel of experts that avoids the "jury room" effect typical of face-to-face discussion. A panel of experts is presented with a questionnaire which asks them to respond, individually and preferably in numerical terms, to a series of questions about which information is sought. The responses to this initial questionnaire are collated and the results are fed back to the panelists. The panelists are then asked to review their previous estimates in the light of the distribution of responses of their colleagues. They are also asked to state their reasons for their estimates, particularly if these are near one or the other end of the distribution of panel responses. This process is repeated for several rounds until, typically, the spread of opinion among panelists is substantially reduced. The media of the last round of estimates is accepted as the consensus among the respondents.

The anonymous debate generated in the Delphi technique reduces the influence of psychological factors, such as specious persuasion, the unwillingness to abandon publicly expressed judgments, and the bandwagon effects of majority opinion. The Delphi process has proved particularly valuable in capturing expert opinion about the nature and likelihood of future events and trends (Gray and Helmer 1975).

This technique has been applied in several thousand studies. These range in application from small, in-house, corporate studies to a nationwide study done by Japan involving 4,000 predictions (Bright 1972, p. 5-1). Application areas are just as diverse and may incorporate such topics as scientific breakthroughs, economic forecasts, medical developments, automation developments, societal trends, employee benefits, physical and biomedical technologies, education developments, and corporate forecasting (Gordon 1972, p. 170). The Delphi technique will be discussed at length in the next chapter.

TREND EXTRAPOLATION

This often used technique is based on the assumption that well-established trend values behave in an orderly manner over time, and thus produce a pattern. Once established, "one can choose appropriate parameters, develop their past time series, and extend them in some manner to predict a future condition or estimate the rate of change" (Bright 1972, p. 6-1). This approach draws heavily on an unproven assumption that technical or social progress exhibits an S-curve (exponential nature), reflecting a slow start growing exponentially, and leveling off. This assumption refers more universally to trends in technological areas and

* For further discussion on these techniques see Wheelwright and Makridakis (1973, p. 48ff.).

probably less so in socioeconomic areas. Gordon (1972, p. 169) points out that such forecasts contain major weaknesses; they "assume that forces which have been at work in the past will continue to be at work in the future. Such an assumption is probably warranted for the near term, but grows less satisfying the further the time horizon is stretched." Gordon notes that techniques somewhat more sophisticated than the "eye-ball" technique for trend extrapolation have been devised. Examples of such techniques fall into curve-fitting methods, which allow "curves with exponents of two, three, or above to be matched to the available data points with least error Some econometric modeling employs factor analysis and multiple correlation techniques to establish the basic regression equations." Regardless of the sophistication of the techniques, the basic assumptions must be made; that is, that past patterns are going to be very much like future patterns. It is this assumption which many forecasters are not willing to make. Trends and trend extrapolation, without the incorporation of "rare events," are often misleading as forecast of future developments.

NORMATIVE FORECASTING

This methodology falls indefinitely between futures forecasting and planning. In one sense, a normative forecast can be regarded as a prognostication of some future accomplishment, while in the same sense, it can be regarded as a policy or planning goal statement. One often cited example of normative forecasting is that of President Kennedy's "announcement" that the United States would put a man on the moon by 1970. This statement can be treated as a forecast, but also it provided a clear planning goal from which planners could work and specify particular, critical objectives (scientific breakthroughs, time schedules, etc.). Normative forecasting examples range from value-laden statements concerning the future to "highly structured reasoning procedures" (Bright 1972, p. 7-1). Examples of normative forecasting approaches are: (1) morphological analysis, in which a matrix of all theoretically conceivable combinations of technological approaches and configurations are constructed and untried combinations are identified; (2) social-technological planes, wherein the thrust of social pressures and technological efforts are identified, their matching gaps are considered, and the intervening institutional planes are examined. The gaps between capabilities and needs are then narrowed or closed; (3) mission flow analysis, a methodology which requires the statement of alternative policies, responses, and technologies required for each possible major future development. By applying the appropriate probabilities and values, an identification of the most useful technology for the future can be selected; (4) relevance trees, a method whose origin is in decision theory. Relevance trees are used in decision theory to "assess the desirability of future goals and to select those areas of technology whose development is necessary to the achievement of those goals" (Wheelwright 1973, p. 190). The best known example of this method is called PATTERN (Planned Assistance Through Technical Evaluation or Relevance Numbers) developed by the Honeywell Corporation.

FORECASTING BY MONITORING

Forecasting by monitoring provides forecasters and decision makers with early warning of potentially important developments. Monitoring requires more than a superficial "scanning" of the environment. It is based upon events and includes the following four activities:

1. Searching the environment for signals that may be forerunners of significant technological change;
2. Identifying possible alternative consequences if these signals are not spurious and if the trends that they suggest continue;
3. Choosing those parameters, policies events, and decisions that should be followed in order to verify the true speed and direction of technology and the effects of employing that technology; and
4. Present the data from the foregoing steps in a timely and appropriate manner for management's use in decisions about the organization's reaction (Bright 1972, p. 8-1).

Examples of the types of signals that might be monitored in communication policy and planning may include the following: (1) technological, including time series of technical parameters, indicators of interest and commitments to specific areas, patent awards, new product demonstrations, etc. Other signals may include data on technical devices routinely in use or new applications of existing devices. Finally, the communication technological environment in relation to usage, implications, and effects; (2) economic, including time series of costs, capacities, demands, resources, and markets. A second economic concern in the area of communication policy and planning may be factors affecting funding levels of various technical or social research areas; (3) social, this includes trends in leisure activities, education, work and/or occupational interests, social indicators of communication needs and rights, as well as attitudes, values, and preferences for particular needs or resources. Other signals may include responses to unique events, books, and conflict in the social environment; (4) political, including political appointments, elections, committees, formulation of agencies, funding of particular programs, etc. Particular attention may be paid to national or state goal statements and the conclusions and recommendations of special committees or research experiments programs.

There are, of course, many potential problems in using the monitoring technique of futures forecasting. For example: (Bright 1972, p. 8-3)

Some signals are evident only in hindsight or very late in the game. This is true partly because the forecaster does not know what to look for. However, he does not claim perfection; he professes that the systematic effort is much better than causal chance procedure.

When a signal is identified, it is possible to draw several or even many possible inferences, and these often are quite at odds with each other. This is true and precisely why all alternatives must be monitored until it becomes clear which developments or impact is really occurring.

There are so many false signals and so much "noise" in the environment that the job is hopeless. This is only half true--it is a difficult task but not always hopeless.

Monitoring is an important technique that augments other forecasting techniques. Although reliability problems exist, they can be minimized by the systematic employment of multiple approaches.

SCENARIOS

The scenario is a method that enables planners and decision makers to consider forces and consequences that might otherwise be neglected. Although no strong theory of scenario building has emerged, it is, and promises to be, an important futures research methodology. Joseph Martino in his book Technological Forecasting for Decisionmaking states:

A scenario is more than just a set of forecasts about some future time. It is a picture of an internally consistent situation, which, in turn, is the plausible outcome of a sequence of events. Naturally there is no rigorous test for plausibility The scenario thus occupies a position somewhere between a collection of forecasts whose interrelationships have not been examined, and a mathematical model whose internal consistency is rigorously demonstrable. (1972, p. 267)

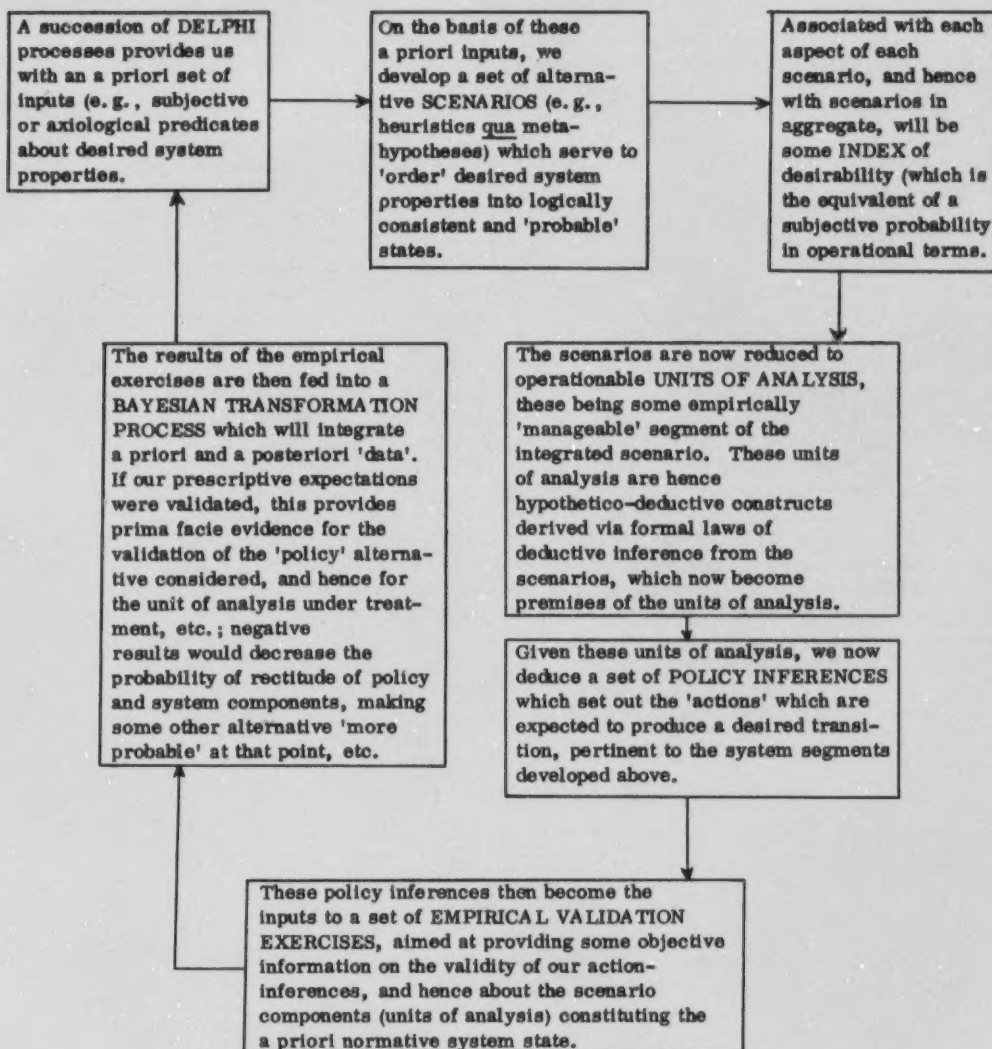
In this sense, a scenario becomes an untested model of some future point in time. It has been referred to as a "future history" which has both strengths and weaknesses, for example, it is extremely dependent on its journalistic creator.

Bright (1972, p. 10-3) reports that "scenarios promise to be a major contribution to technological planning (However) the conclusion of a scenario exercise should carry with it a hearty sensitivity and awareness of probable incompleteness and inadequacy." (emphasis mine)

Herman Kahn (1967) and others have made use of the scenario as a forecasting method popular. It can be regarded as either "normative" or "surprise free" in nature. These two types would differ in the following respects.

The former (normative) would be predicated largely on hypothetico-deductive instruments (e.g. de-factualized or idiographic 'information'), whereas the surprise-free scenario might legitimately be based on largely extrapolative or projective instruments such as those used to generate the "limits of growth," etc. . . . the normative scenario would be a product of intellect and discernment, whereas the latter ("surprise free") would be largely a mechanical exercise in statistical analysis coupled with limited uses of ampliative inductive inference simply extends the properties inherent in some empirical or experiential data base, introducing changes which are matters of degree rather than of quality. (Sutherland in Linstone and Turoff 1975, p. 466)

Scenarios are useful in a normative systems building sense as they tend to organize "system properties into logically, consistent, and 'probable' states" (Sutherland in Linstone and Turoff 1975, p. 485). For a clearer indication of how scenarios are used in system building note the flow in the following normative system architecture process.



The scenario, then, is useful in providing a set of hypotheses which have an ordering effect in the approach to specific research problems. They are relatively comprehensive statements of the interactions of trends and events. Although they lack any theoretical base, they offer a promising method of improving the quality of forecasting and augment the communication policy and planning process.

MODELING

Modeling is basic to the processes of futures analysis or system design. Any attempt to specify an environment, whether it is past, present, or future, involves a conceptualization, referred to as a model. A model has been defined as "any sort of structured process . . . represented by a set of rules which may either be in the form of an algorithm or a set of heuristic principles (Mitroff and Turoff in Linstone and Turoff 1975, p. 20). In a futures-oriented sense, a model is "a representation of assumptions and perceptions about the future" (Amara 1975, p. 1).

In the past ten years, much attention has been paid to what is called "social modeling." Initial social modeling attempts were applied in the field of economics, but have now encompassed many of the social science disciplines. Econometric models, based upon trends only, have been the basis of much criticism because they cannot account for human values and sudden shifts in the modeling process. Because of these shortcomings,

considerable predictability was lost. This has been the basis of the criticism of Forrester's and Meadows' attempt to model on a worldwide basis, the Limits to Growth (1972). This well-known dynamic model relates population, capital investment, geographic space, natural resources, pollution, and food production. It is based upon Forrester's prototype described more fully in World Dynamics (1971). Forrester claims that this model is realistic in depicting and interpreting the complex world system. Meadows (1972) recognizes that this model deals only with physical variables and does not deal very effectively with human values. Nowhere within the model are there any implications that human values or actions will bring about drastic changes in the values of the five physical trends. The assumption is that the trends will remain the same until collapse. (This, of course, will probably not be the case. Any viable social-technical model must incorporate the interaction of the political, social, economic, and environmental forces (in the form of rare events) into its formulation.

A major criticism of the Limits to Growth model is advanced by Cole (1973). This book assesses world models in general and the specific assumptions of Meadows' model. The general conclusion is that the model has particularly weak assumptions concerning politics, social structure, and human needs and aspiration. In this regard, Cole advances "what the general criticisms have shown is that caution is needed with respect to claims made for the results of a model" (1973, p. 134). In spite of the rather detailed criticism, Cole goes on to say that in general

"there seems to be no reason why mathematical models (including system dynamic models) should not eventually become an important tool for structuring, classifying and communicating ideas in the social sciences, as they already are in the natural sciences." (emphasis added)

The criticism of the Limits to Growth model can be applied to all models in general. Past modeling attempts have suffered from many shortcomings, some of which have been set out by Helmer (1976, p. 73): they are undisciplinary, rather than multidisciplinary; they reflect correlations only, rather than causalities; they exhibit trends only, rather than events as well as trends; they contain no explicit feedback loops; and they are deterministic, rather than probabilistic.

Helmer is obviously setting out a framework for subsequent social modeling attempts. In social modeling (or futures modeling), it is difficult to deal with matters of causality, or collect information which incorporates satisfactory quantitative estimates of trend values and the probability of rare, but important events. In this regard Amara states, "often our knowledge and understanding of basic system processes is so poor that primary reliance cannot be placed on any explicit model, either for short- or long-term purposes. . . . When explicit models cannot be constructed, when insufficient historical data are available, or when we are dealing with the longer term future, increasing reliance must be placed on a third method--the use of expertise judgment" (1975, pp. 2-3).

There are five, non-exclusive forms of future-oriented models. These are the mental model, descriptive model, structural model, dynamic model, and the probabilistic model. These models, although overlapping in some regards, can be individually described as follows:

Mental Model--A mental model is individualistic in the sense that it is a world image that is unique to each person. Usually such models lack real definition and are, upon close examination, relatively inconsistent. Nonetheless, they are central to an individual's daily attitudes and behavior, and the basis of an individual's "world view."

Descriptive Model--A descriptive model is a more defined mental model. In this sense the individual "world view" is more structured and can be the basis of communication between individuals. This added structure also provides a stronger basis for prediction.

Structural Models--A structural model is used to further explore and define "world views." In many instances the exploration and definition process is quantitative in nature. It takes into consideration the interrelationships within the sub-system being examined and its relationship with the larger system. Model exploration techniques may employ the matrix, a graph or a decision tree to analyze elements or component interactions.

Dynamic Model--A dynamic model is similar to the structural model in its exploration of interrelationships within and between systems, but adds the element of time to the analysis. Usually this type of model accounts for changes in system behavior over some specified unit of time. This changing behavior is referred to as a systems dynamics.

Probabilistic models--A probabilistic model incorporates the structural model and the dynamic model, but describes the interactions differently. In this regard the relationships between the elements or components are described in probabilistic terms. Cross impact models fall into this category and will be described in detail in Chapter Five.

SIMULATION

Subsequent to the construction of models is the abstract experimentation process called simulation. "Simulation is the approximation of complex systems by dynamic models" (Gordon in Toffler 1972, p. 177). Simulation makes use of models constructed mechanically, as in wind tunnels; mathematically, as in computer simulations; or metaphorically, as in the analogy between human and plant communication. It makes use of a gaming situation involving the interaction of humans and an artificial game environment. In this regard, a simulation game usually involves five elements (Gordon 1972, p. 178):

1. Rules of play to govern the moves and interactions between players, and other variables of the game.
2. Objectives or goals: players may work cooperatively toward a joint goal or competitively toward goals which cannot be shared.
3. A method of translating the moves of the player into indicators which measure the degree of attainment of goals. This device may be a game board, a mathematical model, or another group of participants charged with responsibility of judging the effects of the players' moves.
4. A display system to illustrate the progress of the game.
5. A set of exogenous variables to introduce "outside events" into the play.

Simulation provides a methodology for testing alternative sets of actions (policies) without fear of "real" consequences. As a policy and planning tool it provides many benefits (Gordon 1972, p. 179). The first benefit lies in education of the players in definitions and interrelationships among the variables. Each player gets a sense of the system parameters and develops sensitivities to alternative points of view. In the second place, simulation provides a "framework for systematic review of the issue being studied." In this sense, gaming replaces sporadic, haphazard approaches to problems. Third, it allows the participants to make decisions and to be exposed to situations that are outside their normal environment. In this regard, the game becomes a psychological instrument that allows experimentation decisions and power. Finally, simulation can improve communication and promote relationships between the participants. It builds "new sensitivities to each other's personalities and behavior patterns in real life."

It is likely that simulation techniques will continue to be developed and used in the areas of communication policy and planning. As a methodology it interfaces nicely with other futures research approaches.

CROSS IMPACT ANALYSIS

Cross impact analysis is a technique that "permits the adjoining of an events model, in a natural way, to a traditional trends model of the econometric or system-dynamic type" (Helmer 1976, p. 75). Although a detailed discussion of its history, development, and application will be presented later in this paper, the subject will be treated generally here. Cross impact modeling systematically assesses the interaction and consequently the effects of events on other trends and events. In this regard the technique forces the consideration of development interactions and events and permits the exploration of possible effects of particular policy and planning decisions. Inputs into the cross impact matrix are provided by techniques such as Delphi; they are in the form of trend values and event probability within particular "time scenes."

This analytical technique is a relatively recent development and is still under theoretical and methodological refinement. Helmer and Gray (1975) have provided the following description of the method:

In long-range planning it is necessary to take into account not only the effects of individual developments, but also the effects of the interactions among developments. Cross Impact Analysis is a systematic method for dealing with such interactions in long-range planning. In using the cross impact approach, a planner, before deciding on a policy and an associated action program, first lists the most important potential future developments that are relevant. Such developments generally include both:

- EVENTS (e.g. technological breakthroughs, new legislation) and
- TRENDS (e.g. inflation, demand for service).

For each event, the planner obtains forecasts on the probable time at which the event will occur and estimates of the effects which the event will have on each of the other developments when it occurs. Since the future is uncertain, information about events is expressed in terms of their probability of occurrence in different time intervals. Similarly, for trends, the planner obtains forecasts of the most likely future values of the trends over time, as well as estimates of the effects that significant deviations from these forecasts would have on the other developments. This information can be encoded in a square table such as the one shown.

	T. 1	T. 2	E1	E2	...
T. 1		+ .3		-.2	
T. 2			-.2		
E. 1	+1.1				
E. 2		+.8			
⋮					
⋮					

Here E's represent events and T's represent trends. Each entry in the table indicates the magnitude of the effect (increase or decrease) that one development has on the other. Once such a table has been obtained, it is used in a computer program to determine the indirect consequences of particular developments. The planner can thus determine which developments ought to be promoted and which should be inhibited to achieve the over-all goals. This, in turn, opens the way to exploring the implications of alternative policies and action programs for implementing such policies.

This approach makes it possible to anticipate complex chains of social and technological developments. It is "very effective for studying second-order effects in technology assessment, doing sensitivity analysis, and 'gaming' a model so that the effectiveness of policies can be studied in a longer time frame" (Center for Futures Research 1975, p. 10).

SELECTING THE APPROPRIATE FUTURES METHODOLOGY

With the great assortment of futures research methodologies available, it becomes important to select the most appropriate technique for a particular application. Two of the most important factors in choosing an appropriate technique are knowing the wide range of methodologies available and understanding the strengths and weaknesses associated with each method.

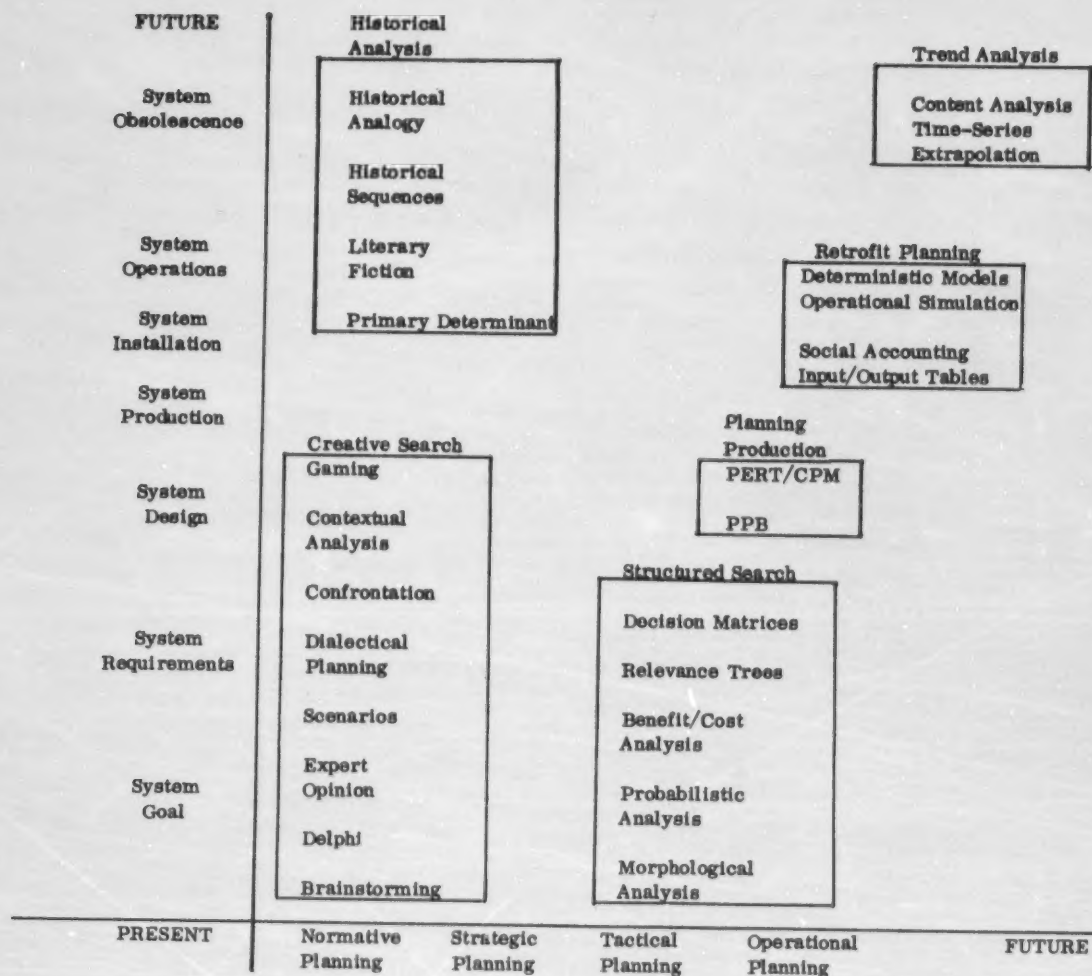
Following the satisfaction of these factors other guidelines can be specified for matching the method(s) with the situation. Wheelwright (1973, pp. 6-10 and 195-219) has set out these guidelines. They generally fall into two categories: the characteristic of the decision making situation, and the characteristics of the various forecasting methods. Subsequent consideration can then be made concerning the time horizon, the pattern of data, the type of model, the cost of the method, the accuracy of the method, and the applicability of the method.

Sackman and Citrenbaum (1972, p. 47) have developed a distribution of planning techniques as a function of time and levels of application. The following distribution assists in choosing an appropriate method for system planning or development.

Most of the futures methodologies in this figure fall within the application area of normative planning and apply most directly to the early stages of system development (for example, establishment of goals, requirements, and system design). Obviously these application areas are closely associated with concerns in policy and planning. They are capable of specifying the general guidelines which shape the actual system design. The figure enables the conclusion that futures methodologies would be less applicable in a tactical or operational sense (in day-to-day systems operation) than to such areas as goal formulation and system design at the macro levels of planning.

Wheelwright (1973, p. 195) also points out that a common misconception in regard to the selection of a forecasting method is the overriding criterion that it "should be the most accurate of the available methods." Although accuracy is important, it is only one of the many criteria that is central to making the final selection.

Finally, it is important that whatever the methodology selected, considerable attention be given to its actual application. A poorly designed and executed futures research study (like any research study) regardless of the methodological applicability to the problem, provides misleading results that lead to improper policy and planning decisions.



DESIGNING COMMUNICATION POLICIES AND PLANS FOR THE FUTURE ENVIRONMENT

It is obvious, although often overlooked, that all communication policies and plans are made to serve in a future environment. Without the appropriate methodological tools these important processes could produce guidelines or actual systems designs that are wholly outdated or inadequate. In an ever-changing environment, it is difficult for the human to account for the complicated, simultaneous interactions of a complex set of trends and events. Yet, in the past, almost all policy and planning decisions were made in this manner. As communication needs, rights, and resources are studied and specified, it will become impossible to formulate comprehensive policies that account for the complex interactions over time. This shortcoming can be an expensive reality. Enzer has made the following assertion:

The combination of long term programs and the rapid pace of change has shaken the confidence of many decision makers who are too frequently confronted with programs that are outdated before they are completed. (1970, p. 18)

This situation is painfully true in regard to decisions involving communication technologies. As the communication infrastructure of a nation, state, or city is increasingly regarded as a societal resource, the methods and approaches used to guide its development must be refined and updated. As pointed out in the first chapter, many ongoing research studies and programs are investigating the complex problems associated with allocating communication resources to meet societal needs. Because need and resources change over time, anticipatory research methodologies must be developed and applied to these problems. The understanding of such methodologies is admittedly limited, and the problems complex. Those who employ these approaches must know that they are working with inadequate data. These images or "models" of future environments will be imperfect and need continual corrections as stronger-based techniques and larger data bases are established. As Toffler has pointed out:

Only when decision makers are armed with better forecasts of future events, when by successive approximation we increase the accuracy of forecasts, will our attempts to manage change improve perceptibly (1972, p. 116).

It is the responsibility of communication researchers, policy makers, and planners that anticipatory communication resource management become a reality. By taking a futures and general systems approach to the problem, it can.

SUMMARY

Policy makers and planners are being faced with communication-related decisions that involve the expenditure of millions of dollars and life expectancies of 7 to 20 years, yet the tools employed to make these decisions and plans, at best, provide inadequate information about the present state of affairs.

Futures research methods, applied to communication policy and planning problems, can provide the insights and data required to strengthen management decisions. By synthesizing futures research techniques and General Systems Theory, a stronger based planning framework emerges. It is from this framework that the needs of the citizen, policy maker, and planner can be served. The framework provides: an "Alternative Futures" approach, attention to cross impacts and interdependencies between alternative futures of different social institutions, emphasis on identification of future developments influencing identity of variables which can serve as future policy instruments, and strict explication of assumptions and rigorous value-sensitivity testing (Dror 1970, p. 165).

Finally, policies and plans are made to serve in a future environment. Present patterns of societal events and trends can be systematically examined and specific conclusions and recommendations can be drawn. This framework has important implications for planning processes in general and suggests that specific futures methodologies should be applied to the communication policy and planning process.

CHAPTER 4: DELPHI AS A TECHNIQUE IN COMMUNICATION POLICY AND PLANNING

INTRODUCTION

The Delphi technique has been in widespread use now for more than a decade. The need to gather data not attainable by physical experiment or other data gathering techniques accounts in part for its origin in the early fifties. One of the problems introduced by systems analysis and futures-oriented policy and planning research is a lack of certainty concerning key factors in the inquiry. As Alan Walter Steiss has pointed out, "There is, and probably can be, no entirely satisfactory way to cope with uncertainty in systems analysis, although some ways are better than others" (1974, p. 40).

In this regard, Linstone and Turoff point to Delphi as an important methodology "when accurate information is unavailable or expensive to obtain, or evaluation models require subjective inputs to the point where they become the dominating parameters . . . and when there is a demand for improved communication among larger and/or geographically dispersed groups which cannot be satisfied by other available techniques" (1975, pp. 10-11).

Helmer and Dalkey (1953) turned to the employment of experts to remove some of the uncertainty faced by system designers and planners. Helmer has pointed out: "Once the fact, however unpalatable, has been accepted that some reliance on intuitive opinions of experts is essential for all planning purposes, it is natural to want to make the procedures for obtaining judgmental information as reliable and efficient as possible" (1976, p. 2).

Here the Delphi technique has emerged as a "cornerstone of futures analysis" (Helmer 1976, p. 3). As one of the leading futures research methodologies it has been defined and used in various manners. Most definitions treat the technique either as a communication device or as a forecasting methodology. The following definitions may be offered:

Delphi may be characterized as a method for structuring a group communication process so that the process is effective in allowing a group of individuals, as a whole, to deal with a complex problem. (Linstone and Turoff 1975, p. 3).

Delphi is basically a technique for gathering and processing the judgments of a group of individuals. This technique has three basic characteristics: structured interrogation, controlled feedback of responses, and anonymity of responses (Amara 1975, p. 6).

Delphi is often presented as a method of collecting data in which the data gatherer acts as an objective collator of the opinions of others (Salancik, Wenger, and Helfer 1971, p. 65).

Whether the emphasis is on communication or on forecasting, the insights provided by (and during) the process are considerable (see also, Ludlow 1975, p. 115). The technique provides a structure for dialogue which also provides judgmental data concerning the problem at hand. The communication and forecasting functions of Delphi will be treated later in this chapter.

DESCRIPTION AND EVOLUTION OF THE TECHNIQUE

The Delphi method was developed at Rand Corporation by Olaf Helmer and Norman Dalkey in the 1950s. It was initially intended that the technique be employed for the "systematic solicitation of expert opinion" (Gordon

and Helmer 1964 p. 5). Delphi was designed in order to avoid the psychological problems present in the traditional approach to face-to-face problem solving. The technique was designed as a program of sequential interrogation (usually conducted by questionnaire) and interspersed with information and anonymous opinion feedback. These three aspects: anonymity, sequential interrogation, and feedback, are common to all conventional Delphi inquiries.

Since its inception, Delphi has been applied thousands of times throughout the world. A typical Delphi procedure involves the selection of a group of experts and the preparation of a first-round questionnaire which poses pre-tested questions, both quantitative and qualitative, about the specific problems to be studied. The questionnaires are either administered by interview, or, more commonly, mailed to the individual panel members. The experts then answer the carefully phrased questions and return the questionnaire to the monitor/researcher. The results of the round are then tabulated by computing the semi-interquartile range (that is, middle 50 percent of the responses) and the median. The second-round questionnaire is then prepared. The questions are the same, along with any new questions suggested by the panel of experts in the initial round. Summary statistical information from the first round is also included in the second round as "feedback" to each of the individual experts. The experts are then asked to carefully consider the feedback in responding to the second-round questionnaire. If their responses on this round are outside the interquartile range, they are asked to provide information about their rationale for the response. The questionnaires are collected by the monitor/researcher and again the interquartile range and medians are computed. In this second round, each "rationale statement" for the responses falling either higher or lower than the previous round's interquartile range are summarized and fed back to the experts for the third round. The third (and usually final) round questionnaire reflects the same questions as the first two rounds.* The feedback information provided for the expert by the monitor is used to prepare the final response to each item. The final round responses are collected, and again the interquartile ranges and medians are computed. These figures are accepted as the panel's consensus (or lack of consensus in the case of bimodal or equally distributed responses) concerning the development in the inquiry.

The final medians and interquartile ranges have a number of valuable uses. They have the obvious value of education and communication within the panel of experts. In addition, for those developments (trends and even statements) that reflected consensus "Delphi polls have established a reputation of leading to fairly accurate forecasts" (Southern California Edison [SCE], 1974, p. 1). In the situation where no consensus has been exhibited, (for example, a bimodal distribution) "Delphi polls have provided early warnings of incipient political issues, areas of disagreement and potential conflict" (SCE 1974, p. 1). In either situation (consensus or non-consensus), the information provided is valuable to planners or policy makers.

FOUNDATIONS AND ASSUMPTIONS OF DELPHI

Recently there have been attempts to reconceptualize established philosophies in the context of more recent "management sciences" (Churchman 1971). This approach stresses the application of various philosophies to the design of inquiry systems as a basic aid to decision making. Directly in line with this approach, Van Gigh notes, "the Delphi processes embody these epistemologies—that is, the inquiring systems by which we aim at discovering the truth" (1974, pp. 324-325).

Mitroff and Turoff (1975) have also been concerned "whether the philosophical basis or system of inquiry that underlies a proposed technique or methodology (Delphi) is sound and appropriate." Their approach parallels that of Van Gigh in that it shows "that there is more than one fundamental basis which can underlie any technique . . . there is no one 'best' or even 'unique' philosophical basis which underlies any scientific procedure or theory" (Mitroff and Turoff 1975, p. 17). As any new technique emerges there is discussion concerning which, if any, philosophical foundation underlies the particular method of inquiry. By examining Delphi with regard to the fundamental historical stances of establishing the "truth content" of a system of communication signals or acts, it becomes possible to focus on Delphi's major strengths and weaknesses. The conclusion of Mitroff and Turoff is that there is no single test "for insuring our understanding of the content of a set of communication acts or for ascribing validity to a communication . . . no one mode that is best in all senses and for all circumstances, [this] is not to say that each of these modes does not appear to be 'best suited' for some special set of circumstances" (1975, p. 18).

If Delphi is to demonstrate viability as a method of inquiry, it is important to understand which particular philosophical system of inquiry can "best fit" the various Delphi applications and to examine how the Delphi system of inquiry specifically and concretely relates to General Systems Theory and, more generally, to the philo-

* Note: Two rounds of Delphi are usually sufficient in forecasting applications, whereas three rounds are desirable if the technique is being used as a communication device.

sophy of science.

PHILOSOPHICAL MODES OF INQUIRY

There are many modes of Delphi inquiry and many "truth seeking" philosophical systems (inquiry systems). The following discussion will summarize five of these systems--Lockean, Kantian, Hegelian, Leibnizian, and Singerian.

LOCKEAN (following the methods of inquiry of John Locke). This system relies on "agreement as the sole or major principle for producing information." The data precedes the development of formal theory. The Delphi application concerned with developing group "consensus," (referred to as the Conventional Delphi) is a prime example drawing its base from Lockean philosophy.

KANTIAN (following the methods of inquiry of Emmanuel Kant). This system has as its express purpose "to elicit alternatives on which to base a comprehensive overview of the issue." Kant believes that data and theory exist simultaneously, and that some proper combination of data and theory justify the propositions. Examples of Delphi applications in this regard can be found in most technological forecasting approaches.

HEGELIAN (following the methods of inquiry of Friedrich Hegel). This system is based on the premise that these conflicting approaches produce "synthesis" or "the true nature of the whole system." This system is dialectical in nature. It considers why the opposite view is not true. The best example of a Delphi application involving Hegelian philosophy is that of Turoff's Policy Delphi. The policy Delphi is dialectical in nature and allows conflict of positions to surface in the dialogue. It is an increasingly valuable tool in policy and planning.

LEIBNIZIAN (following the methods of inquiry of Gottfried W. Leibniz). This system stresses that "truth" is analytic. The model is both separate and prior to the data. The model is formal and symbolic. A direct Delphi application is not found; however, the Leibnizian approach is best thought of in the general areas of Operations Research. In a sense the development of a cross impact model utilizing Delphi data is the reverse operation of "knowing" by the Leibniz system.

SINGERIAN (following the methods of inquiry of E. A. Singer). This system stresses holistic thinking. Truth is pragmatic. The designer is very much a fundamental part of the system being designed. This type of inquiry indicates how each technological-scientific system has within it a basic set of ethical presuppositions. Although no direct applications of a Singerian Delphi exist, there are direct applications to designing the Delphi inquiry and to modeling the "collective reality" of the experts' minds. The Singerian method of inquiry provides a strong base for methodological research on the Delphi process as a mode of communication.

These five systems of inquiry are individually and specifically related to widely differing Delphi applications. By being able to tailor specific approaches of inquiry to specific problems, the various "inquiry systems can be considered the 'software' of applied general systems theory" (Van Gogh 1974, p. 325). Using this premise, the Delphi method's relationship to the scientific method is as follows: Delphi is specifically related to the various philosophical inquiry systems of Kant, Hegel, Locke, Leibniz, and Singer. These basic inquiry systems provide the framework (software) for investigation within General Systems Theory; and General Systems Theory, as has been demonstrated in chapter two, relates closely to the processes of the scientific method. From this reasoning, it can be tentatively concluded that the Delphi method draws some theoretical strength from the scientific method of inquiry.

DELPHI AS A FORECASTING TOOL AND AS A COMMUNICATION DEVICE

Earlier in the chapter reference was made to two different definitional approaches or emphases of the Delphi technique. These approaches stress using the methodology either as a forecasting device or as a communication medium. Although Helmer, in a personal communication in 1974, primarily views the technique as a "method of obtaining an opinion consensus from a panel of experts concerning long-range developments [he goes on to say] . . . it should be noted that the use of Delphi is not restricted to long range forecasting." (emphasis added) The technique can be appropriately applied to group decision making, specialized communication, and a host of other applications.

Linstone and Turoff have pointed out that, "While many people label Delphi a forecasting procedure

because of its significant use in that area, there is a surprising variety of other application areas" (1975, p. 4). Among the Delphi applications already developed we find the following:

- Gathering current and historical data not accurately known or available;
- Examining the significance of historical events;
- Evaluation of possible budget allocations;
- Exploring urban and regional planning options;
- Planning university campus and curriculum developments;
- Putting together the structure of a model;
- Delineating the pros and cons associated with potential policy options;
- Developing causal relationships in complex economic or social phenomena;
- Distinguishing and clarifying real and perceived human motivations;
- Exposing priorities of personal values, social goals.

The range of application is wide. It is not limited to forecasting or to communication, but extends into areas of assigning priorities to values, model construction, and budget allocation. It is important to note that whether the fundamental nature of the application is forecasting, decision making, alternative exploration, or communication, the reasons leading to the adoption of the technique are similar. Some of the rationales for employing the Delphi approach are as follows:

The problem does not lend itself to precise analytical technique but can benefit from subjective judgments on a collective basis.

The individuals needed to contribute to the examination of a broad or complex problem have no history of adequate communication and may represent diverse backgrounds with respect to experience or expertise.

More individuals are needed than can effectively interact in a face-to-face exchange.

Time and cost make frequent group meeting unfeasible.

The efficiency of face-to-face meetings can be increased by a supplemental group communication process.

Disagreements among individuals are so severe or politically unpalatable that the communication process must be referred and/or anonymity assured.

The heterogeneity of the participants must be preserved to assure validity of the results, i.e. avoidance of domination by quantity or by strength of personality ("bandwagon effect"). (Turoff 1975, p. 4)

The adoption of Delphi as a policy and planning tool requires a reorientation of social/scientific goals and a shift toward "adoption of some of the methods of operations research, notably the construction of simulation models and the systematic use of expert judgment" (Helmer 1973, p. 4).

Here there is much overlap in using Delphi as a communication device and as a forecasting methodology. There is no clear distinction of where one function stops and the other begins, and there need not be. Conventional Delphi is always a communication device and almost always involves some form of forecasting. In viewing Delphi in this manner, it is possible to structure human communication so that a "collective intelligence" or "collective reality" emerges in order to better understand, influence, and control the world around us. Since Delphi can always be regarded as a communication structure for group problem solving, it is helpful to clarify its relationship with other group communication techniques. The advantages of each mode can be compared on various characteristics. The following table is helpful in this regard.

These modes offer insights into various group interactions. In communication policy and planning the process of group interaction is important. Delphi provides certain advantages over conferences by telephone, committee meetings, or formal seminars. Notably, it is flexible in group size and length of interactions; it allows relatively random occurrence of interaction and is usually less expensive than group activities involving travel. Finally, it minimizes the psychological effects and time demands associated with other group communication techniques.

STRENGTHS AND WEAKNESSES OF DELPHI

Like any new or existing research methodology there are inherent values and drawbacks in its application.

Group Communication Techniques*

	Conference Telephone Call	Committee Meeting	Formal Conference or Seminar	Conventional Delphi	Real-Time Delphi
Effective Group Size	Small	Small to medium	Small to large	Small to large	Small to large
Occurrence of Interaction by Individual	Coincident with group	Coincident with group	Coincident with group	Random	Random
Length of Interaction	Short	Medium to long	Long	Short to medium	Short
Number of Interactions	Multiple, as required by group	Multiple, necessary time delays between	Single	Multiple, necessary time delays between	Multiple, as required by individual
Normal Mode Range	Equality to chairman control (flexible)	Equality to chairman control (flexible)	Presentation (directed)	Equality to monitor control (structured)	Equality to monitor control or group control and no monitor (structured)
Principal Costs	Communications	--Travel --Individuals' time	--Travel --Individuals' time --Fees	--Monitor time --Clerical --Secretarial	--Communications --Computer Usage
	Time-urgent considerations	Forced delays		Forced delays	Time-urgent Considerations
Other Characteristics	--Equal flow of information to and from all --Can maximize psychological effects		--Efficient flow of information from few to many	--Equal flow of information to and from all --Can minimize psychological effects --Can minimize time demanded of respondents or conferees	

* Linstone and Turoff 1975, pp. 8-9.

Delphi is no exception. The technique has been reviewed by many, but the most extensive work has been done by Harold Sackman. Sackman, a former researcher at Rand Corporation, assessed the premises, rigor, and viability of the technique and concluded that Delphi did not meet the social science standards set out by the American Psychological Association. This conclusion has been challenged by many. An entire issue of Technological Forecasting and Social Change (7, 111, 1975) was devoted to "Delphi and Its Ramifications." In this issue, Goldschmidt stated:

Sackman's first strategy is outlandishly misleading. He compares the Delphi Technique to the American Psychological Association's standards . . . [The] standards refer to standardized tests that are used to make predictions or statements about the individuals tested on the basis of their responses to test items They are not meant to be standards "for social experimentation and for opinion questionnaires." (1975, p. 198) (emphasis added).

Sackman chose to define the Delphi Technique as a psychometric instrument and went on to criticize his erroneous definition. Linstone has said this concerning Sackman and his critique:

Science to Sackman means psychometrically trained social scientist. His tradition-bound attitude is not uncommon; it is the same vein as the illusion that science is objective, that only Lockean or Leibnizian inquiry systems are legitimate, and that subjective or Bayesian probability is heretical. Orthodoxy faced with new paradigms often respond with sweeping condemnation and unwitting distortions. Poorly executed applications are brought forth to censure the entire method, quotations are taken out of

context, the basis for criticism is left vague, significant supporting research and new directions are ignored, and irrelevant "standards" are applied (1975, p. 573).

Joseph Coates, of the Office of Technology Assessment, United States Congress, says of the Sackman critique, "Sackman ignores the crucial point that Delphi is not a scientific tool, nor is it related to a scientific experiment or a scientifically structured activity. Delphi is not a way of drawing forth expert knowledge on expert's issues, but rather is an aid to dealing with those most crucial of contemporary societal problems; judgment and wisdom about the future We face a crisis of concepts, ideas, alternatives, diagnoses, foresight and planning. Delphi is an attempt to deal with all of that" (1975, p. 193).

The debate will go on, and it is important that it does so. As closer examinations of Delphi are made, the inherent strengths and weaknesses of the approach can be exposed and addressed. The result will be more appropriate and useful applications of the technique in the long-range policy and planning process.

STRENGTHS OF DELPHI

Since a large proportion of this chapter has already been devoted to the usage and positive values of the Delphi technique, only a short section will be devoted to its strengths and a more definitive section will be provided on its weaknesses.

Generally, Delphi can be regarded as a good communication channel that informs, extracts, and conveys information to and from the participating panel members. As a research methodology employed in policy and planning, it can provide a "good reading of a consensus of expectations" of those participating in the process (SCE 1974, p. 2). This is consistent with one of the conclusions of the Delphi Forecasting Study (1975, p. 5) conducted by Telecom Australia. It stated, "The primary role of Delphi is in identifying contemporary assumptions about the future developments. It does this in a manner which is consistent with the aims of open planning."

This statement is important here because most policy and planning decisions are made using as guidelines the expectations of probable futures. By employing a well selected and balanced panel of experts from diverse fields of intents, new insights, and common assumptions can be explored. This resulting synthesis of "world views" provides a broader and more "open" approach to problem solving than past methods have produced.

Another strength of the technique lies in its ability to "put our preferences into perspective" (SCE 1974, p. 2). Delphi assists in identifying preferences for a particular alternative future and in goal formulation. Goals made without reference to a preferable future can easily become counterproductive, while goals and plans made without reference to an expected future can easily become futile (SCE).

Paralleling this, Amara sees an additional advantage. He states:

The value of Delphi must be judged in the light of goals sought and in comparison with the alternatives available to achieve those goals . . . the most important advantages are that Delphi:

May make it possible to obtain the collective judgment of a group of individuals without introducing psychological problems of direct group interactions (e.g. bandwagon effect) that may limit or degrade the quality of information;

May expose real agreement and disagreements among respondents; and

Gives the investigator a simple and direct control of the scope of an investigation (1975, p. 12).

The advantages commonly associated with the Delphi technique are also of central concern in communication policy and planning activities. These activities specifically require collective judgments, exposure of agreement and disagreement, and methodological control of the process.

Finally, the Delphi technique provides a methodology for anticipating and imagining alternative futures. New insights and ideas can be an important product of a properly administered study. Delphi can provide "a point of departure for retuning our images of tomorrow. Part of this retuning may include the considerations of comments, and judgments which lie outside of the consensus opinion. These survey responses and participants' statements of rationale can provide new insights and ideas valuable to management beyond the findings of the consensus. We can learn where the cliff is, without having to fall over the edge to do so" (SCE 1974, p. 3). This advantage is particularly important when one is confronted with a wide range of complex and interrelated alternatives. Insights or priorities of possible alternative futures provide policy makers and planners with a stronger base from which to make tradeoffs and decisions. Delphi can provide these common insights and priorities.

WEAKNESSES OF DELPHI

Putting aside the Sackman critique for now, there are a number of potential problems that can arise in the application of Delphi. Linstone (1975, pp. 574-586) has set out eight of the basic pitfalls repeatedly found in Delphi applications.

1. Discounting the future. This problem involves the intuitive application of a discount rate to the future. This universal practice occurs because citizens, researchers, planners, or policy makers tend to be more concerned with the present than with problems of 5-30 years hence. Occurrences that appear to be farther into the future are heavily discounted because uncertainty increases as a function of time and space. Thus, the range of alternatives becomes difficult to handle and the "possibility of accidents (low probability events) and irrational actions increase." It is hoped that by ignoring the longer-term future considerations, that additional options or solutions will surface and the need for a decision will be eased or disappear. This is particularly true in governments and organizations where near-term achievements dictate re-election or promotion. Discounting in Delphi forecast extends into the past as well as in the future. That is, recent events influence respondents more strongly than more distant events. "Thus the individual's time perception distorts his own data base as he integrates it to develop an 'intuitive' judgment or forecast" (Linstone 1975, p. 575).
2. The Prediction Urge. This addresses our human need for certainly and stresses the "search for the 'truth' or the single best model." (emphasis added) This is also present in the interpretation phase of the Delphi inquiry. This is more problematic in the Consensus Delphi than the Policy Delphi. That is, the stress in the Policy Delphi is to bring forth alternatives and differences and not to produce high degrees of convergence which could be interpreted as indicators of "truth."
3. The Simplification Urge. This refers to the preference toward simplicity over complexity. Behavioral and social scientists have fallen prey to the same type of reductionism that have been applied to the physical sciences. Human beings have trouble visualizing large, complex, multiple interacting systems and tend to over-simplify patterns when making decisions. This also applies to the Delphi process. Linstone states, "intuitive procedures such as Delphi usually lean heavily on subject probability assessments. And most human beings exhibit a tenacious tendency to simplistic misjudgments and biases in dealing with such problems" (1975, p. 580). These problems associated with the simplification urge are potentially softened by the employment of cross impact analysis in conjunction with the Delphi process. This does not imply that cross impact analysis eliminates the problem, yet the internal consistency of the "over-simplified results" are brought into consideration in the analysis.
4. Illusory Expertise. Inherent within Delphi is a strong reliance on the concept of "expertise." The expert, or the specialist, has been guilty of focusing on a particular area of knowledge, at the expense of the whole. In such cases, "the use of Delphi to elicit judgments from such experts would only have systematically reproduced the error . . . in short, a consensus of experts does not assure good judgments or superior estimates" (Linstone 1975, pp. 581-582). To lessen this potential problem a strong effort should be made to select representative, balanced (that is, balanced socially, culturally, and sexually) panels of experts.
5. Sloppy Execution. Unfortunately, this has been a recurring problem with Delphi. The monitor or monitors are guilty of selecting friends, or "like-thinking" individuals, and proceed to conduct the inquiry. In addition, the monitor may not have participant interaction as the goal of the inquiry, and consequently, poor summarization and feedback is provided between rounds. Linstone states, "It is incumbent upon the analyst that he provide the atmosphere of a fruitful communication process among peers, that time is not wasted on obvious aspects, that subtleties in responses are appreciated and understood" (1975, p. 583). Other examples of poor execution include superficial analysis of responses and lack of imagination by the designers of the questionnaire.
6. Optimism-Pessimism Bias. This refers to short-run forecasts, which are usually biased toward over-optimism, and long-term forecasts, which are plagued by pessimism. This is usually a product of being tied too closely to the present and personal experience. The problem is reversed when dealing with technological achievements. Further complications occur when taking into consideration that most Delphi panelists are by nature, quite separate from the process and either pessimistic or optimistic.
7. Overselling. This refers to over-enthusiasm for applying Delphi for any or all problem situations. "A person who wants to introduce a new communication system, such as Delphi, into a group setting must also ascertain that he is not acting under false premises concerning the psychology of the

potential user community" (Linstone 1975, p. 584). The designer should always evaluate the user and/or the community in which the study is to take place.

8. Deception. The problem of deception is relatively unknown or acknowledged. Obviously the technique, like any other research technique, can be used to deceive or manipulate. This can be done in the feedback phases of the inquiry, or in the final interpretation of results of the study. This type of propagandistic usage of Delphi is made all the more possible by the employment of the anonymity aspect of the process.

Obviously, these problems will not be resolved simply by acknowledgment of their existence. Linstone points out, in the conclusion of his article, that:

All of these pitfalls exist to greater or lesser degrees no matter what communication process we choose to utilize in approaching a problem. However, since an honestly executed Delphi makes the communication process and its structure explicit, most pitfalls assume greater clarity to the observer than if the process proceeds in a less structured manner The Delphi designer who understands the philosophy of his approach and the resulting boundaries of validity is engaged in the practice of a potent communication process. The designer who applies the technique without this insight or without clarifying these boundaries for the client or observer is engaged in the practice of mythology. (1975, p. 586)

The weakness of the Delphi Technique, like any other research technique, should be properly accounted for in the results and inferences drawn from the inquiry; not to do so would constitute misrepresentation of the data and a violation of research ethics.

THE PROBLEMS OF EXPERTISE AND CONSENSUS IN DELPHI

EXPERTISE

Two of the most questioned aspects of the Delphi techniques involve the concepts of "expertise" and "consensus." Expertise pertains to "expert knowledge upon which professional authority can be found" (Brockhoff, in Linstone and Turoff 1975, p. 295). Webster's dictionary defines an expert as "one who has acquired special skill in or knowledge of a particular subject." Sackman and other critics question the concept and claim it to be "scientifically untenable and overstated" (Sackman, 1974). Sackman states that:

The experts selected may not be representative of all "experts" and may even be purposely biased by the Delphi monitor to increase the probability of achieving a prediction that is favorable to his interest.

Even if this former condition did not hold, . . . experts do not make better predictions than non-experts.

Sackman's first point exposes one of the major weaknesses, aside from his initial definition of his entire critique (that is, that a universe of all possible experts exists and that, somehow, a random sample of "representative experts" should be selected). This is neither possible nor desirable in applying the technique.

The required level of expertise in many problems may limit the number of available experts to an extremely small number. By definition, each expert is a unique combination of high level abilities. Simply, there is no "universe of experts."

Goldschmidt addresses the second part of Sackman's initial criticism. He states:

One should not overlook the possibility that Delphi practitioners may purposely select persons who they think will make predictions more favorable to them (it should be noted that if the monitor has no a priori knowledge of what predictions the experts will make, this is quite a feat) nor that investigators, Delphi or otherwise, are above ignoring all empirical data, and simply adjusting the outcome of their experiments. Such behavior is obviously unprofessional and should be deplored, but it is related more to ethics than to science. (1975, p. 200)

It is no doubt true that Delphi has been unethically applied in the past, but as Goldschmidt points out, any scientist can ignore all empirical data, utilize any method, and adjust the outcomes of the experiments. His conclusion is well taken—it is "related more to ethics than to science."

Sackman's second point questioned whether experts make better predictions than non-experts. He cites McGregor and Cantrell (1938) as proof.

In his analysis Sackman concludes that the predictions made by a group of "experts" and a group of "non-experts" were demonstrably linked to values and attitudes toward the subject matter.

The author (Cantril) states that the accuracy of the 1938 conclusion is still tied to the determination of the actual events. Goldschmidt concludes that "two predictions undifferentiated as between experts and non-experts cannot be the basis for Sackman's assertions." Goldschmidt goes on to point out that McGregor's conclusion, "no significant difference between their (the experts) predictions and those of the other subjects possessing roughly the same attitude," is not acceptable. He states:

If one accepts McGregor's finding, a prediction will represent one of the following, listed in order of influence: (1) An extrapolation based on relevant information; (2) the hopes of the predictor; or (3) simply a guess . . . these findings are surprise-free, in that they do not run counter to common sense or intuitive thinking; one would expect people to predict rationally, if they act or think rationally. (1975, p. 202)

Finally, Goldschmidt questions whether McGregor's experts really constituted experts at all. He concludes that they did not.

The real question of what constitutes expertise in the first place is central to the resolution of these conflicting positions. Unfortunately, the concept of expertise is not well understood. Van Gigch (1975, pp. 332-333) has attempted to clarify this important concept. He states:

An expert can be recognized according to some of the following measures:

The number of variables which he considers important in reaching a decision. The expert uses fewer variables than the nonexpert.

The relative importance or weight which he accords to these key variables, in comparison to the nonexpert.

The speed or efficiency he displays in identifying the important signals of the situation.

The accuracy of his decision--how close his answers come to the optimum.

The reliability of his predictions--how often he makes the correct decision.

While these remarks are useful, they do not clarify how experts can be chosen or recognized in regard to a less measurable situation, as in the case of policy and planning and futures research. One solution is to use past measures of "expertise" as indicators of present expertise. Helmer and Rescher (1969, p. 59) suggest that there are two criteria, reliability and accuracy, pertinent to the selection of qualified experts. Reliability refers to measures of how often a particular expert makes a correct prediction when faced with several alternatives (for example, the percentage of successes over the total number of trials for each expert). Accuracy refers to how far each of an expert's prediction lies from the "true" value; it is a measure of dispersion (Van Gigch 1974, p. 336).

In addition to measuring and using accuracy and reliability as a basis of selecting experts, there are also possibilities for improving expert opinion and its collection procedures. Bright (1972, p. 5-2) suggests that these might take the form of a Dialectic Approach, which emphasizes the philosophical concepts of Hegel and has been treated by Mitroff in "A Communication Model of Dialectical Inquiring Systems--A Strategy for Strategic Planning." (Management Science, June 1971) A second possibility is the Psycho-Heuristic Approach, which involves the experts in confrontation intermediated by the monitor. It would force the experts to have a more rigorous understanding and reasoning behind their responses. A third possibility for improving expert opinion is Forecasting by Exclusion. This approach may be based on excluding unlikely developments. Thus, a narrowing effect may be elicited which reduces possibility of error; and lastly, Learning from Past Errors. This would employ past study forecasts (as baseline information) and attempt to build upon them what is already "commonly" known. It would require the analysis of past errors in judgment and suggest possible remedies.

These techniques may offer some improvement to the systematic process of using experts and expert opinions, but there are still many unanswered questions. Helmer, a co-developer of the technique, poses:

If two or more experts supply probability distributions over time for the occurrence of some potential future events, what is the appropriate mode of combining their individual estimates into a joint probability distribution? What use can here be made of any available performance calibrations or information about the systematic bias of experts? How can the judgments of experts belonging to different fields of specialization best be combined into an interdisciplinary estimate? (1975, p. 6)

These questions and many more are yet to be answered. Obviously, additional research is required to more precisely define and utilize expertise in forecasting. Problems of expert availability will no doubt hinder such experiments, yet it is necessary to continue to explore the systematic use of experts, if we are to understand and refine this important process.

CONSENSUS

Consensus supplies a second problem area in the application of the Delphi technique. Although less problematic than expertise, there are differing points of view concerning the value of consensus or non-consensus in Delphi results. On one hand, consensus indicates agreement on a particular set of future events or trends. This information is very valuable in the policy process and greatly facilitates the planning process. On the other hand, lack of consensus is important in indicating where issues may experience future conflict. Marvin Adelson and Samuel Aronson state:

Consensus may increase the probability of--i.e. facilitate the process of reaching (or avoiding)--a particular future state of affairs, or increase the conviction that it will occur, but dissension points up where issues are likely to arise, where more information may be needed, or where the fact of diversity must be acknowledged and taken into account (1975, p. 435).

The point is that much information is contained in both consensus and non-consensus. In many cases, it is just as important for the researcher or decision maker to identify the diversity of opinion in the policy and planning process as it is to seek out similarities. The value of Delphi in this process is that these patterns of expectations, or images of the future, are exposed. In this regard, the technique can "improve by at least a little bit the basis for forecasting, and such related functions as policy-setting, decision making, planning, designing, communication, and interaction." (Adelson and Aronson, in Linstone and Turoff, 1974, p. 434)

There are a number of ways that consensus and non-consensus have been operationally defined. Usually "consensus is assumed to have been achieved when a certain percentage of the expert responses fall within a predetermined range. For example, consensus has been defined as occurring when "the interquartile range is no larger than two units on a ten-unit scale" (Scheibe, Skutsch and Schofer, in Linstone and Turoff, 1975, p. 277). This approach, however, does not always take into full consideration the information available in the distribution, (for example, a bimodal distribution). Obviously, in such situations, non-consensus of opinion has occurred. This latter case provides information of another sort--it indicates "an important and apparently insoluble cleft of opinion" (Scheibe, *et al.*, 1975, p. 277). Information of this nature is important to policy makers and planners in understanding or anticipating potentially conflicting issues.

Other measures of consensus have been proposed by Van Gigch (1974, p. 333). He states, "measures of consensus are of two kinds: (1) measures of reliability and accuracy, and (2) measures of agreement." The concepts of accuracy and reliability have been dealt with in the section on expertise. Measures of agreement involve rank correlation methods developed by Kendall. In using this method of measuring agreement, "coefficients of concordance" are computed. This is useful "in cases where agreement is sought on the relative rankings of several objects (Van Gigch 1974, p. 336).

In a properly conducted Delphi, both consensus and non-consensus have equal potential for evolving. It is the monitor's responsibility to assure that issues are properly represented in the summarization and feedback processes in order that the results correctly reflect the actual group opinions.

THE POLICY DELPHI

The Policy Delphi was introduced by Murray Turoff in 1969. It differed significantly from the Conventional Delphi that stressed "consensus among homogeneous groups of experts [The Policy Delphi] seeks to generate the strongest possible opposing views on the potential resolution of a major policy issue" (Turoff, 1975, p. 84).

Turoff viewed a policy issue as one in which no experts exist, just "informed advocates and referees." In essence, the expert is considered the advocate and represents one position in regard to an issue.

The assumption made by the Policy Delphi is that a decision maker does not want a group decision, only options and evidence in regard to the problem. "The Policy Delphi is, therefore, a tool for the analysis of policy issues and not a mechanism for decision making" (Turoff 1975, p. 84. The Policy Delphi can be carried out with ten to fifty people. It serves the following objectives:

To ensure that all possible options have been put on the table for consideration;

To estimate the impact and consequences of a particular option;

To examine and estimate the acceptability of any particular option.

The Policy Delphi accomplishes these objectives in the following six phases:

1. Formulation of the issues. What is the issue that really should be under consideration? How should it be stated?
2. Exposing the options. Given the issue, what are the policy options available?
3. Determining initial positions on the issues. Which are the ones everyone already agrees upon and which are the unimportant ones to be discarded? Which are the ones exhibiting disagreement among the respondents?
4. Exploring and obtaining the reasons for disagreements. What underlying assumptions, views, or facts are being used by the individuals to support their respective positions?
5. Evaluating the underlying reasons. How does the group view the separate arguments used to defend various positions and how do they compare to one another on a relative basis?
6. Reevaluating the options. Reevaluation is based upon the views of the underlying "evidence" and the assessment of its relevance to each position taken.

The Policy Delphi generates a lot of written material and does not result in quantitative indications of consensus or dissention. Although the Policy Delphi cannot provide inputs for the development of a cross impact model, it serves a valuable purpose in the policy and planning process. A Policy Delphi could be run prior to a Conventional Delphi. In this regard, options and issues could be opened and explored and subsequent establishment of priorities could take place.

SUMMARY

The Delphi technique is a useful tool in the policy and planning process. As in any methodology, it has inherent strengths and weaknesses that influence where and when the methodology should be applied. The properly conducted Delphi (both conventional and policy) should stress an element of dissention in order to avoid leading to an artificially produced consensus. This does not guarantee viability of results, but as pointed out earlier in this chapter, "there is probably no entirely satisfactory way to cope with uncertainty" in systems or futures analysis. Delphi is one method that provides insights and data into an analysis. It is capable of systematically gathering and processing group judgments that aid in the exploration of complex problems associated with communication policy and planning.

CHAPTER 5: CROSS IMPACT ANALYSIS AS A METHODOLOGY FOR COMMUNICATION POLICY AND PLANNING

INTRODUCTION

Future events and trends do not operate in isolation; they interact and influence the subsequent probability, timing, and impact of other developments. Cross impact analysis is a systematic method of considering and modeling the interrelationships between individual events and trends over time. Normal Dalkey defines cross impact analysis as a "method for revising estimated probabilities of future events in terms of estimated interactions among those events" (1975, p. 327). Amara states, "the cross impact matrix method has been described and used as a technique for examining the dominant interactions among a set of events or developments" (1972, p. 267). This is done by estimating how the occurrence (or nonoccurrence) of each event subsequently affects the occurrence (or nonoccurrence) of other developments. It is in this regard that second-order effects of specific trend levels and event probabilities can be examined.

Bright states, "cross impact analysis attempts to do, in fact, what is implied in all forecasting—to provide a prediction of future conditions with due allowance for all the interacting forces that will shape that future. Even in its simplest form it improves the internal consistency of a set of forecasts and clarifies underlying assumptions. It exposes gross errors and inconsistencies" (1972, p. 11-1. [emphasis mine])

The basic concepts of cross impact analysis (cross impact gaming) were originally set out in 1970 by Olaf Helmer and Theodore Gordon in *Futures*, a game developed for Kaiser-Aluminum Corporation. It represented an effort to "refine the forecasting approach afforded by the Delphi Technique" (Helmer 1973, p. 9). Presently at the center for Futures Research, University of Southern California, a prototype computer program, representing several programming iterations, facilitates research in this area. This cross impact program facilitates more systematic research of alternative policies and their future implications . . . and stimulates the decision making process that constitutes the planning of preferred futures" (Helmer 1972, p. 149).

Cross impact analysis is a recent and rapidly developing methodology, hence, only a few sources exist that provide relevant, up-to-date insights into the process.

Generally, cross impact analysis serves the following three basic purposes:

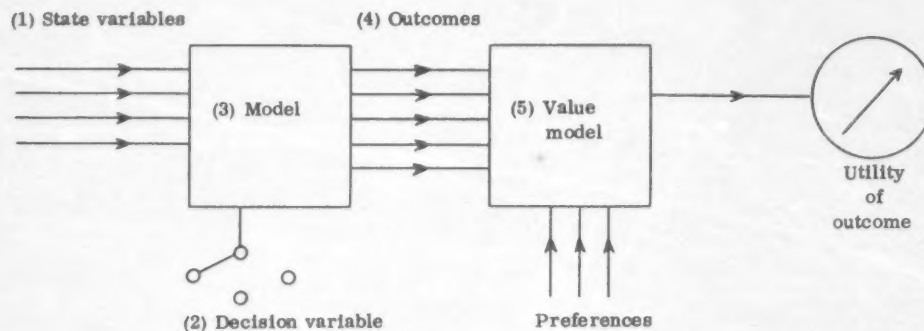
1. Sensitivity Studies. Where the effects of a change in one development affects other developments in the long term.
2. Scenario Development. The generation of a few typical representative scenarios that can assist decision making agencies in its planning effort.
3. Comparative Policy Analysis. Testing various combinations of policies to provide insights into the most promising. (Gray and Helmer, 1974, p. xii)

In each case the emphasis is on assisting in the decision making process. The processes of considering the sensitivity of one development to another and the generation of representative scenarios suggests alternative policy options. The cross impact technique provides insights regarding specific policy consequences of the various options available. Early in its development Gordon pointed out that although cross impact analysis has no general supporting theory, it "would almost certainly permit the exploration of the side effects of decisions under consideration . . . and might also be useful in illuminating less expensive means of attaining

goals through investment in high-payoff areas which initially seem to be unrelated or only weakly linked to the decision" (1972, p. 180). [emphasis added] This perception generally proved to hold true. Three years later, Turoff viewed the technique more precisely within a policy, planning, and management framework. He saw the utilization of the cross impact technique as: (1) a modeling tool for the analyst, (2) a consistency analysis tool for the decision maker, (3) a methodology for incorporating policy dependencies in large scale simulations, (4) a structured Delphi Conference for group analysis and discussion efforts, and (5) a component of a lateral and adaptive management information system (1975, p. 338).

Although Helmer, Gordon, and Turoff differ somewhat, their approaches all contain overlapping purposes in regard to policy decisions and management information. In each approach, cross impact analysis is viewed as a modeling tool which assists in the analysis and refinement of decisions in order to move toward more preferred futures. Not only does this gaming methodology increase the understanding of interactive relationships of trends and events, but also it "refines and improves the Delphi forecasts themselves" (Bright 1972, 11-2).

The general framework for moving toward an analysis model for communication policy and planning has been set out by Lipinski (1971, p. 3). The following general approach is suggested: (1) State variables describe the state of the environment over which the policy maker is assumed to have no direct control; in communication policy and planning these might be the general economic climate, the state of the art of communications technology, changing social environments and values, and so forth. (2) Decision variable is the "switch" operated by the policy maker. This refers to different policy options with regard to communication in a given society. (3) The interaction of the state and decision variables produces, for each decision option, a particular set of consequences. (4) Outcomes identified by the levels of a number of quantitative or qualitative "outcome indicators." Each set of outcomes is then evaluated by the policy maker (who could be a single person or a group) according to a personal or collective value model. (5) Utility which is the result of an overall (multi-attributed) use measure of that set of outcomes. Graphically, the policy analysis structure would appear as follows: (Lipinski 1971, p. 4)



BASIC PROBLEM STRUCTURE FOR POLICY ANALYSIS

This general model suggests a basic structure for policy analysis. Nowhere within Lipinski's analysis is there any specific mention of cross impact analysis, although he sets out the basic requirements that parallel the inherent capabilities of the technique (pp. 16-17), that is, ability to handle many variables, high dynamic and high probability. This coincides with Helmer's previously mentioned specifications for the attributes of a good model (1976, p. 73). He stipulates that it must be "multidisciplinarity, (pay) attention to causal effects, (allow for) inclusion of rare events, allowance for feedback, and (should have) consideration of probabilistic uncertainty." These attributes have been incorporated to varying degrees in the development of the cross gaming approach.

ASSUMPTIONS AND MATHEMATICS OF CROSS IMPACT MODELING

The following discussion will draw extensively from a paper written by Steve Alter (1976), The Mathematics of Time-Dependent Cross Impact Modeling: or Everything I Think I Know About This Topic.^{*} Alter's work provides the latest and most definitive analysis of the internal workings of cross impact gaming.

^{*} Unless otherwise stipulated, all quotes in the following sections are cited from Alter (1976).

It deals specifically with the assumptions and mathematical schemes used in cross impact modeling. While the internal workings of the computer model are complex, it is important to understand the optional schemes for computing the event occurrence probabilities, and the options for specifying the "impact" and "carry-over" of an event on subsequent trends and events.

There are basically three computational schemes used in calculating the conditional probabilities needed for time-dependent, cross impact modeling. These are the Additive Method, the Likelihood Multiplier Method, and the Z-Space Method. Each method requires different assumptions on behalf of the user and the nature of world. The following sections provide details on each computational scheme.

THE ADDITIVE METHOD

In this method $p(A/B) = a + x$. That is, the impact of the previous occurrence of event B is to increase the probability (p) of A by some amount x. This is also true in the reverse situation where x is negative and the occurrence of B decreases the probability (p) of A by some amount (if A and B are independent $x=0$).

One of the problems of this scheme is that "impossible probabilities could also result easily from the non-occurrence of impacting events whose cumulative probability is high." It is possible to avoid this illegal condition through a period-by-period calculation of the maximum negative and positive aggregate impacts that could occur, the "basic point is that the additive method is extremely fragile (and) surprisingly difficult for people to deal with mentally." These two problematic conditions, impossible probabilities and difficulty in application, make this scheme less desirable than the likelihood multiplier or Z-space method.

THE LIKELIHOOD MULTIPLIER METHOD

The likelihood multiplier, on the other hand, takes advantage of several useful properties of odds, which seems to be more natural for people to handle. In this method, people are asked to estimate cross impacts in terms of the amount by which the odds of the impacted event would be multiplied if the impacting event occurred. Thus: Odds $(A/B) = x * \text{odds}(A)$, that is, the cross impact (x) of B on A is the product of the cross impact times the odds of (A). If A and B are independent, x would be equal to 1.

As in the additive method, "the likelihood method can generate impossible probabilities," but is "not nearly as prone to impossible results as is the additive method." A second advantage of the likelihood multiplier method is that "it seems to do a better job than the additive method in using a single cross impact parameter for each impacted-impacting event pair." One disadvantage of the likelihood multiplier method is "that it cannot be as meaningful as the likelihood multiplier method across a wide range of prior probabilities for the impacted event."

THE Z-SPACE METHOD

The Z-Space Method (developed by Gray and Helmer) is an "effort to extend cross impact analysis to permit both the use of soft, qualitative data, and the incorporation of period-by-period simulation results from standard economic models." Cross impacts can, in effect, be additive in this Z-space. That is, if there is qualitative agreement that an impacting event has a moderate positive impact, then, its occurrence results in an increase of 1.0 in the Z score of the impacted event, thus shifting Z by "one standard deviation" . . . after all cross impacts have been registered, the adjusted probability is obtained directly from the final Z score. This is also useful in obtaining the numerical estimates of initial cross impacts. In this method a seven-point scale: -3, -2, -1, 0, +1, +2, +3 is used. This allows the rating of the impact from a very strong negative impact (-3), no impact (0), to a very strong positive impact (+3). The assumption is made that the scale represents standard deviations in a Z-space. This method allows the cross impact to be calculated from period to period. The weakness of the method is also the strength; it obtains precise results (in the form of particular scenarios) from imprecise inputs. On the positive side, as might be expected, "it is impossible to produce conditional probabilities which are illegal" using the Z-space method.

The most promising potential relationship among these methods concerns the likelihood multiplier and the "Z-space" method. Alter states that if such a relationship can be worked out (it has not yet), "it will lead to a better understanding of the real magnitude of the 'standard deviation units' that have been used as a numerical interpretation of qualitative data under the Z-space method" . . . and "the link between the two methods might lead to a more robust way to do likelihood multiplier calculations."

CALCULATING THE EFFECTS OF THE CROSS IMPACTS

As mentioned earlier, a second major concern in order to effectively employ cross impact analysis is the method of calculating the "effect" and "decay" of a particular impacting event on other events or trends. Alter points out that it is important to be able to relax restrictions if any realistic modeling is to take place. These

restrictions are: (1) The impact of the previous occurrence of B upon the probability of A is independent when B occurred. (2) Events can occur only once. (3) Pair-wise cross impacts are independent and can be aggregated through a calculation rule.

Another important consideration in making the cross impact model more realistic is in regard to the "effective magnitude" of a cross impact over time. This refers to the length of time between the occurrence of the impacting event and actual impact, the duration of the effect, and the decay rate of the effect on the impacted event or trend. Three approaches have been formulated: (1) three parameter formulation, (2) the delay = 1, decay = 0 formulation, and (3) the six parameter formulation. The following figures indicate these three approaches.

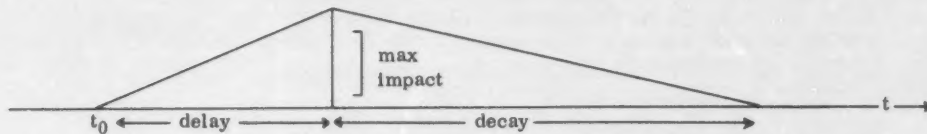
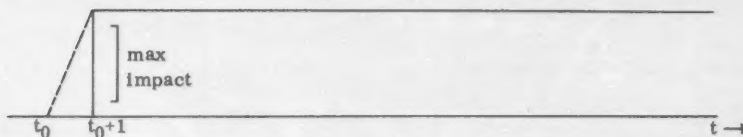
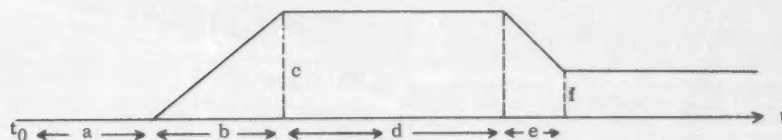


Illustration of 3 Parameter Cross Impact Formulation



Graph of Impact Where Delay=1, Decay=0



A Six Parameter Formulation of Cross Impacts

Each of these three formulations have two adverse effects. They require "additional information and more complicated inputs from people," and the mathematical balancing law "acquires a large number of additional terms to integrate over all possible times of occurrence for the impacting events."

Probably the most understandable, and the simplest in terms of additional inputs, is the approach suggested by Gray and Helmer. This employs two parameters, maximum impact and carryover. The carryover is defined as "the percentage of the impact which carries over from one period to the next." In the case where the impact is felt in only one period, the carryover is 0; if it is a carryover of 1, there is no decay. Intermediate carryovers decay exponentially. The carryover applies only to those events that occur, and do not impact non-occurring events. Re-occurring events can be modeled in the existing cross impact model, but "it requires the recasting of the recurring events into a sequence of individual events which can only occur in a prespecified order." By doing this, the "first, second, and third occurrences of an event can all have an impact on an impacted event."

Another potential problem in cross impact analysis is that of double counting. This refers to a situation where "B impacts A and C, and C impacts A, standard cross impact calculations would effectively count B's impact twice." It is very important to avoid this confounding situation. Presently, this can only be done by paying specific attention to those events and trends that are bi-directional and incorporate only those that have

legitimate double impacts.

In spite of these shortcomings, it seems important that research continue in refining cross impact analysis. It is important to understand these internal options and how they affect the outputs of the cross impact model. Obvious mental advantages that augment policy and planning occur in the systematic consideration of the impacts of one set of developments (policy) on a second set of events or trends. Whether these and additional values of employing this type of analysis are worthwhile, given the present tradeoffs in theoretical rigor, remains to be tested.

STRENGTH AND WEAKNESS OF CROSS IMPACT ANALYSIS

In addition to the mathematical and theoretical considerations outlined by Alter (1976), there are methodological and pragmatic strengths and weaknesses associated with this research method. Specifically, some of these limitations have been characterized as:

1. Only interactions among event/trend pairs are considered;
2. Multiple accounting of probability assignments can occur because of inherent ambiguities in the nature of the interactions; and
3. An adequate theoretical base for probability relationships does not exist. (Amara 1975, p. 24) [emphasis added].

Presently, combinations of three or more event and trend impacts cannot be accounted for in the two-dimensional matrix. Even in a two-dimensional matrix it is difficult to avoid multiple accounting (for example, trend 1's impact on trend 5, and trend 5's impact on trend 1).

These problems are also recognized by Helmer. He states, "a serious shortcoming of the method to date is the fact that only the interactions among pairs of developments are examined . . . even with regard to merely two-dimensional cross impacts, there are still some unresolved technical problems. They have to do with: (1) The avoidance of double accounting; (2) the balancing, over time, of the impact of the occurrence of an event and the impact of its nonoccurrence; and (3) the nature of impacts on trends, specifically, whether they should be considered to be causing persistent shifts in their future course, or gradually declining shifts, or merely temporary blips." (1976, pp. 78-79)

Despite the inherent (and I hope, short-term) problems pointed out by Alter, Amara, and Helmer, there are important positive aspects of employing the cross impact approach. In this regard, Amara has pointed out that cross impact analysis can assist in:

1. Organizing data that describes important interrelationships;
2. Facilitating communication among members of a group involved in this structuring; and
3. Exploring strategies for achieving desired outcomes or preventing undesirable outcomes. (1975, p. 24) [emphasis added]

These important advantages are augmented by Enzer. He points out, "the major advantages of the cross impact technique are its ability to account for interactions among many events systematically; to organize data describing a large number of possible outcomes so that a relatively small number of inputs are sufficient; to test the sensitivity of average outcomes to changes in initial likelihoods of occurrences or in sequence, or both; and to provide logical retraceability, in that a change in probability (initial to final) can be reviewed and the reason why the changes occurred can be ascertained, at least generally" (1970, p. 23).

This latter point is central to policy option simulation. That is, the ability of cross impact analysis to test the sensitivity of a particular trend or event in regard to a contemplated policy decision. In this regard the reasons for the subsequent shifts in particular trends or events can aid decision makers in foreseeing probable consequences of potential policy or planning actions. Finally, Helmer points out:

The cross impact approach together with the Delphi Technique, deserve close examination because they offer a structural remedy to models currently in prevalent use that cannot be attained by standard methods of refinement usually applied to such models, namely, the disaggregation of model components into subcomponents and the infusion of more precise data. A model can be very effective in mirroring

real world relationships, even if it is relatively coarse and imprecise The realism of an econometric model, for example, may suffer from the omission of vital socio-psychological factors or of technological breakthroughs and acts of legislation (1976, pp. 79-80). [emphasis added]

It is clear that cross impact modeling carries inherent strengths and weaknesses to policy and planning applications. While no adequate, well-confirmed theory exists that underpins the cross impact approach, it seems apparent that some benefits are derived even by crude social modeling. In the absence of a strongly based, well-confirmed social model Helmer suggests that a "cross impact matrix may well represent the next best thing to an as yet non-existent theory" (1976, p. 80).

PROCEDURES FOR BUILDING A CROSS IMPACT MODEL

Once a clear understanding of the assumptions, strengths, and weaknesses of cross impact modeling are known, a decision regarding its applicability to a given situation can be made. If the decision is to use the technique, then certain guidelines can be followed. Enzer has specified the following:

1. A set of important developments that may occur in the future is described (Questionnaire Formulation).
2. Probabilities of occurrences for the abrupt events and projected levels of trend values are estimated (Delphi Technique).
3. Cross Impact Factors describing the impact of a change in one development on the other developments are estimated (Preliminary Cross Impact Matrix).
4. The developments and the cross impacts are then analyzed to understand how changes in some of the developments may alter the others and thereby produce futures that differ markedly from nominal projected states (Sensitivity Analysis). (1975, p. 4)

A set of important developments can be formulated in various ways. In many cases, the Delphi technique is used to elicit opinion data from experts. This data reflects time series estimates of the probabilities of occurrences for events and projected levels for trends. The cross impact factors are estimated by assigning (sometimes by the procedure called a "mini-Delphi") a value of -3, -2, -1, 0, +1, +2, +3 in the cross impacting cells of a matrix as in the matrix below (Helmer 1972, p. 160).

	T ₁	T ₂	T ₃	T ₄	T ₅	T ₆	T ₇	T ₈	T ₉	E ₁	E ₂	E ₃	E ₄	E ₅	E ₆	E ₇			
T ₁		.1		-.6															
T ₂				-.4	-.3		.2	.1	.2								.3		
T ₃		-.7	-.3					-.3	-.4										
T ₄			-.5		-.2	-.2	-.2	-.3									-.2		
T ₅		.3	.4	-.2				.2											
T ₆		.6		-.5			.3	.4											
T ₇																			
T ₈																			
T ₉	1.2	.3																	
E ₁	.9					.8	1.5	.8	.4										
E ₂	1.7								.2										
E ₃	.5					.4													
E ₄	.6			-.2						.1	1.5		1.5						
E ₅	.5																		
E ₆	1.1		.4						1.4										
E ₇	1.2	.5		-.3	1.2		.2	.5	1.4										

The data is then entered into a cross impact computer program, where additional fine tuning and sensitivity analyses can be performed.

Gordon provides a seven-step procedure which overlaps and extends Enzer's steps for the employment of cross impact analysis. He specifies the following sequence:

1. Assessing the potential interaction (cross impacts) among individual events in a set of forecasts, in terms of:
 - a. direction, or mode, of the interaction,
 - b. strength of the interaction, and
 - c. time delay of the effect of one event on another;
2. Selecting an event at random and "deciding" its occurrence or nonoccurrence on the basis of its probability;
3. Adjusting the probability of the remaining events according to the interactions assessed as likely in Step 1;
4. Selecting another event from among those remaining and deciding it (using its new probability) as before;
5. Continuing this process until all events in the set have been decided;
6. "Playing" the matrix in this way many times so that the probabilities can be computed on the basis of the percentage of times that an event occurs during these plays; and
7. Changing the initial probabilities of one or more events and repeating Steps 2 to 6. (1972, p. 182)

Steps 1 through 6 are considered fine tuning and "playing" the cross impact game. Step 7 is the most important in regard to policy and planning applications. In Step 7 the probabilities of the events or trend values can be manipulated in accordance with potential policies (that is, policy options). This can be done by adjusting the event probabilities or trend levels from the initial amount to an assumed probability of "1.0" and/or assigned new trend values. By making subsequent "gaming runs" (10-100 cycles) to properly allow for the percentages of event occurrence, general indications of policy outcomes over time can be simulated. This procedure can be done to a large number of policy options. The various outcomes of the policy option runs can be analyzed by decision makers. The results provide additional information, in regard to consequences, of contemplated policy actions.

SUMMARY*

Cross impact analysis is a relatively recent methodological development which appears to lend strong assistance in the refinement of opinion data and policy option simulation. Although it has some internal weakness, as specified by Alter and others, the technique provides an important dimension to the communication policy and planning process. It is expected that continued programming efforts and experimentation will increase the predictive power of the technique. Presently, cross impact analysis can assist in the policy and planning process by assessing the effects of one development on other developments and by generating representative scenarios of contemplated policy actions.

Cross impact analysis, in conjunction with the Delphi technique, provides a viable methodological approach to long-range communication policy and planning.

* Note: This methodology is still going through refinements and programming iterations. The best single source of up-to-date information is the Center for Futures Research, University of Southern California, Los Angeles.

CHAPTER 6: FORECASTING FOR COMMUNICATION POLICY AND PLANNING IN HAWAII: SUMMARY OF AN APPLICATION*

INTRODUCTION

This study addressed long-range forecasting of communication needs, supplies, and rights as inputs to the policy and planning process in the State of Hawaii.

The review of literature included discussions of the requirement for incorporating a feedforward control device in policy and planning activities; an overview of communication policy and planning activities; a communication paradigm involving needs, resources, and rights; and, application of Delphi as a method in long-range communication policy and planning.

Three rounds of Delphi inquiry were conducted using 60 communication experts in the State of Hawaii. The experts were matched into pairs on the basis of responses to self-rating forms and randomly assigned to one of two groups. The experts in both groups were asked to estimate the levels of communication need, supply, and right for 24 communication concepts for the years 1976, 1991, and 2006, and to indicate the years by which there would be a 10 percent, 50 percent, and 90 percent chance that each of the 17 communication-related events will have occurred.

The consistency of the final round forecasts was tested by comparing the results of the two groups. In addition, a post-inquiry assessment was administered to the participants. From these measures, it was concluded that the Delphi method proved to be a valid and reliable communication technique for ascertaining future forecasts of communication developments. The experts indicated the satisfaction, usefulness, and face validity of the results.

The study results provide specific trend-level forecasts and rankings for 24 communication concepts for the years 1976, 1991, and 2006. The rankings reveal the relative importance ascribed to each communication need and right, as well as the availability of particular communication supplies.

Two indices, a policy urgency index (PUI) and a dynamics index (DI), were developed to indicate possible future imbalances and growth of each of the 24 communication needs, supplies, and rights over the 30-year period. These indices play a major "foresight" role in revealing particular areas in which policy research and action should be undertaken. Among those requiring prompt attention due to imbalances were: openness to government, privacy, and citizen information. Those trends forecasted as most dynamic over the next 30 years include electronic message flows, mobile communication, and small-group (electronically interposed) communication.

Events forecasts supplement trend findings in that the occurrence or nonoccurrence of each affects the levels and probabilities of other developments. Of the 17 events forecasted, those with the most impact include the 50 percent probability of an energy crisis occurring by 1980 (equal to or greater than the crisis of 1973); a 50 percent probability of electronic home delivery of a newspaper by 1985; and 50 percent probability that Hawaiian Telephone Company will be replacing co-axial cables with optical fibers by 1990.

Three major recommendations were made. The first calls for establishing a data base regarding the ten

* The following is a summary of 1978 Dissertation: "Forecasting Communication Needs, Supplies and Rights for Policy Making and Planning in the State of Hawaii," Dan J. Wedemeyer, University of Southern California.

most significant areas (as prescribed by the PUI and the DI). The second recommendation calls for the development of a cross-impact computer model using the trend and event forecasts derived from the Delphi study. The final recommendation suggests that a communication and information section be drafted, publicly discussed, and incorporated into the 1979 Hawaii State Plan. The results of the study stimulated and strengthened the Hawaii communication policy and planning process by demonstrating the reliability of the Delphi forecasting method, and reduced the uncertainty regarding future levels of communication needs, supplies, and rights.

APPROACH TO STUDY

Communication in the State of Hawaii is increasingly being regarded as an important and valuable resource. As a resource that can be created, it has both the potential of substituting for, and reducing the consumption of other diminishing, scarce, or expensive resources. Communication, in this regard, can be considered a linking resource among all resource systems. Because of these and other inherent organizational characteristics, it becomes important that communication policies and plans be developed that are comprehensive and long-range in nature, and that insure that social needs and rights are met by advancing configurations of technologies.

In order to accomplish these goals there is a need to develop a policy and planning framework that has at its core a systematic and ongoing analysis of the communication environment of the State. It is from this analysis that an informative base for policy and planning can emerge. The data base development process must not only capture information concerning past and present needs, rights, and available supplies, but must also provide insights into future communication developments and potential problems or issues.

ASSUMPTIONS OF THE STUDY

In this study, I started with four basic assumptions as guidelines for designing my long-range communication policy and planning research. The first assumption is that communication is a natural resource in the State. As previously stated, it is a resource that can substitute for, or take on the characteristics of, other diminishing or expensive resources. For example, there exist telecommunication-transportation tradeoffs. Communication can be used to reduce the consumption of energy while reducing the time and associated mental and physical hazards of commuting to and from work. In this instance, communication has assumed the "nature" of oil and time resources, to name but two. Other resource substitution examples can be provided, but the important thing is that the way in which we structure our societal pattern of communication (policy and planning) is very important and will be even more so in the future.

The assumption is that communication research, policy, and planning must be treated holistically and systematically. One cannot separate communication resources from other resources in the environment. They are interdependent.

The third assumption is that human communication needs and rights should be the basis for all technological decisions. In the past, we have tended to let technologies dictate what we "needed" or had the "right to" in the communication environment. From recent literature, I think that this approach is beginning to turn around somewhat.

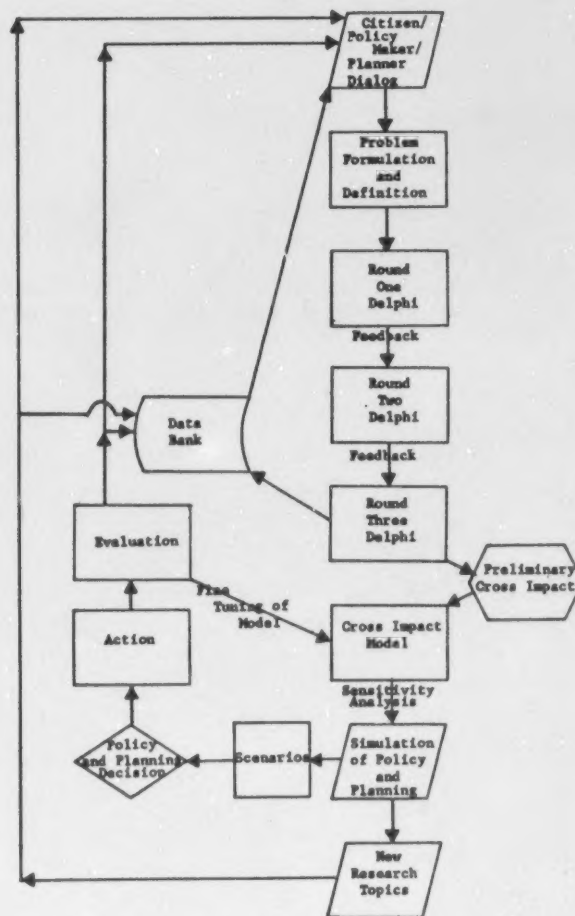
The fourth assumption is that communication study and the resulting policies and plans must be increasingly regarded as long-range in nature. Many of the policy and planning decisions made today carry with them 20-30 year commitments. For instance, if Hawaii decides to allow the construction of another undersea cable system, we are committing ourselves to a 10-20 year arrangement in order to amortize the investment. Along with this, we are committing ourselves to rate structures and technical capabilities that may not follow the declining costs or advancing capabilities of emerging systems. The assumptions that we fail to make in today's policy and planning decisions concerning future communication needs and rights are inhibiting as we move into the future. Therefore, the more information we have concerning possible future environments (that is, the less uncertainty) the more closely our policies and plans will match evolving human needs and rights.

THE POLICY AND PLANNING CYCLE

Using these four assumptions as guidelines, I have synthesized an approach to communication policy and planning.

In my study of long-range communication developments in Hawaii, I have initiated part of one policy cycle.

The study was conducted jointly at the East-West Communication Institute and the Annenberg School of Communication, University of Southern California. To gather information for the research, a first round of inquiries was sent out in November 1976, and the third and final round of surveys were received in May 1977.



POLICY AND PLANNING CYCLE

The process starts with a dialogue between concerned citizens and those charged with policy and planning decisions. From this dialogue, problems surface and are mutually defined. The information gained from this activity is used to plan research approaches and questionnaire designs. It was recommended that the results of the three rounds of Delphi inquiry (forecasts in the form of trend levels and event probabilities) be used as inputs into a cross-impact computer model. The model allows for, among other things, the simulation of policy options in order that decision makers can "view" possible consequences prior to policy actions. In addition, the cross-impact model is capable of generating a large number of scenarios which may assist in policy and planning decisions. In short, the proposed policy cycle promotes the collection of information, poses difficult and interpretational tradeoff questions, suggests priorities for new research topics, and simulates consequences of contemplated policy and planning actions. The process also provides information to citizens, and contributes to an information data base for ongoing public dialogue in subsequent cycles. The outcome of the process should be improved communication policies and plans for the State.

WORKING DEFINITIONS

As one might expect, defining and setting priorities for communication needs and rights is very difficult. In order to remove some of the uncertainty, I have used the following definitions in the study:

BASELINE COMMUNICATION NEED: The level required to function without experiencing urgency, privation, or destitution. It is NOT the bare minimum, nor is it a utopian level--it is somewhere between these two extremes.

Take for example, the need for food. Using this definition, we are not talking about the lowest level that maintains life; at the same time, we are not talking about three nine-course dinners every day. The baseline need level is somewhere between these two extremes.

SUPPLY LEVEL: The means, technology, and/or personnel available to a SOCIETY, at a particular time period to serve communication needs. This does NOT refer to potentially available resources, only those available for use in the specified time period.

The definition requires less explanation than does needs or rights. Essentially, the available supply refers to the resources (both human and technological) that are available to meet demonstrated (or possibly created) communication needs.

STRENGTH OF RIGHT: The intensity of that which is due to anyone in a SOCIETY by just claim, legal guarantees, moral principles, etc.

The rights dimension adds a previously excluded element of "humanism" to the otherwise market driven (that is, supply and demand) policy and planning structure. It is similar to, and highly correlated with, communication needs, but clearly goes beyond needs in the moral and legal sense. During the inquiry rounds, rights came to mean the intensity of a society's demand that the communication supply be in balance with the need. In this study, rights are used as a weighting factor in determining policy urgency.

These were the working definitions that were provided to the experts in the first round. They were asked to forecast the specific levels of communication needs, supplies, and rights for the State of Hawaii for the years 1976, 1991, and 2006.

CHOICE AND ASSIGNMENT OF EXPERTS

Sixty experts were chosen from a list of 500 persons who had attended communication conferences in Hawaii during the last five years. Incidentally, the list was the initial group to receive profile questionnaires for the Hawaii Communication Directory.

The sixty experts were divided into two panels of thirty members each. This was done by first matching pairs of experts according to a self-rated profile and randomly assigning each member of the pair to a group. This technique is later to serve as a validity check on the final round forecasts. The two panels were also balanced in terms of educational levels, years of experience, self-ratings of expertise, etc. In addition, an effort was made to balance the panels by areas of employment (for example, government, university, industry, etc.) and by island location. Finally, there was a concern for representation from both sexes, although there is unquestionably an over-representation of males on both panels. A list of organizations and professions represented on the panels follows:

Organizations/Professions Represented

Hawaii Public Broadcasting
Clergy
Hawaii State Representative
Hawaii State Senators
Dillingham Corporation
Honolulu Advertiser
City and County of Honolulu
University of Hawaii, Manoa
University of Hilo, Hilo

Hawaii Visitor Information Program
Private Advertising/PR Agency
State of Hawaii/D C Division
Honolulu Media Council
East-West Communication Institute
Hawaii State Commission on Year 2000
Hawaii Department of Planning and Economic
Development
Hawaiian Telephone Company

Maui Community College
Windward Community College
C. Brewer and Company
PEACESAT

Retired-Inventor, Professors,
Researchers
Hawaii Council of Presidents
Private Television Producers

SELECTED DEVELOPMENTS

When one starts to systematically investigate alternative futures, one of the ways it can be approached is by constructing questions concerning specific trends and events. In this particular study, the following developments were used.

TRENDS

- T1 Mobile Communication
- T2 Security Communication
- T3 Openness in Government
- T4 Citizen Information
- T5 Two-Way, Interactive
- T6 One-Way Communication
- T7 Persuasive Communication
- T8 Entertainment Communication
- T9 Citizen Involvement Political Decisions
- T10 Capital Investment in Communication Infrastructure
- T11 Face-to-Face Communication
- T12 Civil Defense Communication
- T13 Electronic Message Flows
- T14 Small Group Communication
- T15 Citizen Participation/Local Community
- T16 Self-Expression
- T17 Education Communication
- T18 Serendipitous Communication
- T19 Privacy
- T20 Cross-Cultural Communication
- T21 Societal Communication in General
- T22 Access to Means of Communication
- T23 Monopolistic Control of Communication
- T24 Anticipatory Communication Skills Development

EVENTS

- E1 Establishing of First Public Video Conferencing Center in Hawaii
- E2 Utilization of Optical Fibers (Replacing Co-Axial Cables) by Hawaiian Telephone
- E3 An Energy Crisis Equal to or Greater than 1973 Crisis
- E4 Twenty-five percent of Hawaii's Homes have Installed a Digital Storage Device
- E5 Establishing of "Dial-Up" Pay Television Service to Homes
- E6 The Passage of Legislation Requiring a Telephone in Every Island Home
- E7 The Passage of Legislation Requiring Rate Averaging (Telephone) for Hawaii
- E8 First Occurrence of an Electronic Delivery of Newspaper to Island Home
- E9 Occurrence of Electronic Home Polling (Not Telephone Polling) by State Government
- E10 Legislation (Passed) that Establishes a Severe Tax (\$500) on Second Family Car
- E11 Establishment of Free Mass Transit on Oahu
- E12 Occurrence of State Gasoline Rationing on Regular Basis
- E13 Physical Est. of Neighborhood Communication/Work Center (Not Shopping Center)
- E14 Statewide Requirement of "Keyboard Skills" in the Public Schools
- E15 Passage of a State "Communication Bill of Rights"
- E16 Twenty-five percent of all Shopping Transactions are Performed Remotely (Electronically)
- E17 A Technical Breakthrough that Provides Inexpensive and Virtually Unlimited Spectrum Space

I was mainly concerned with communication concepts that perform general functions in Hawaii's Society. These concepts, framed in trend and event questions, represent developments that will be potentially very important for the next thirty years in the State.

QUESTIONNAIRE DESIGN AND DISCUSSION OF ROUNDS

The questionnaire was designed and pretested in order to facilitate easy comprehension and completion by the experts. A sample page is shown below.

	CONCEPT	DEFINITION	FORECASTS								
T3.	Openness of Government	Open, prepared and posted agendas and provision for citizens to attend all government meetings.	Baseline NEED Level			Available SUPPLY Level			Strength of RIGHT		
			ABSOLUTE 100 90 80 70 60 50 40 30 20 10 NONE 0			% 100 90 80 70 60 50 40 30 20 10 0			ABSOLUTE 100 90 80 70 60 50 40 30 20 10 NONE 0		
			1976	1991	2006	1976	1991	2006	1976	1991	2006
Place a dot (·) on each column indicating your estimate of the need, supply and right.											
T4.	Citizen Information	Consumer information, schedules for services and events, legal medical and health information open and conveniently available to citizens.	Baseline NEED Level			Available SUPPLY Level			Strength of RIGHT		
			ABSOLUTE 100 90 80 70 60 50 40 30 20 10 NONE 0			% 100 90 80 70 60 50 40 30 20 10 0			ABSOLUTE 100 90 80 70 60 50 40 30 20 10 NONE 0		
			1976	1991	2006	1976	1991	2006	1976	1991	2006
Place a dot (·) on each column indicating your estimate of the need, supply and right.											

In each of the surveys the experts were given 24 communication concepts (for example, mobile communication, privacy, security communication, etc.) and a working definition of each. They were asked to establish a "benchmark" level for 1976 and to project the levels for 1991 and 2006.

During the first round, the experts had only their own intuitive feelings for the direction and intensity of the concept levels. The total number of responses for the first round was 49 out of 60 (second round responses were 30/57 and third round responses were 31/54). Each of the individual responses was entered onto a master graph, and medians and semi-interquartile ranges (the middle 50 percent of the responses) were computed. In the second round the experts were asked to review the information supplied from the first round (that is, the medians and interquartile ranges) and make their second round estimates. This time, if their estimate was outside the first round interquartile range, they were asked to justify their second round forecast in narrative form. The justification statements were to provide a rationale for their deviation from the group. Oftentimes, an expert has access to special information that other members of the group do not have. These statements introduce new information into subsequent rounds. All justification statements were kept anonymous, but they were fed back to each group (along with the second round medians and interquartile ranges) for the third and final round of estimates. The third round required the experts to review the justification statements, the group medians and interquartile ranges, and to make a final forecast for each need, supply, and right level.

At the end of the three rounds, the estimates of the two panels were combined and the resulting means, medians, and interquartile ranges were checked for consistency. One hundred eighty-eight of the 216 trends (87 percent) met criteria for consensus; 31 of 51 events (61 percent) met the criteria. A consensus is attained when 50 percent of all responses (falling on either side of the median) fall 20 or fewer points apart on the 100-point scale for trends, and 50 percent of all responses fall plus or minus 3 years from the median for events.

The experts cooperated very well, considering the amount of time required for each round (estimated at about 1-3 hours) and the small reward offered for their participation.

RESULTS OF THE DELPHI INQUIRY

The final round means were computed for each of the 24 concepts. These means represented the experts' final forecasts for each trend for the years 1976, 1991, and 2006. These means were then rank-ordered for needs, supplies, and rights. These rankings appear as follows:

COMMUNICATION NEEDS RANKINGS

1976	1991	2006
75.36 = T11 Face-to-Face Communication	85.38 = T29 Privacy	85.85 = T9 Citizen Involvement
74.35 = T9 Citizen Involvement Pol. Dec.	79.42 = T9 Citizen Involvement Pol. Dec.	85.51 = T5 Two-Way Communication
72.95 = T19 Privacy	78.89 = T3 Openness in Govt.	85.29 = T9 Citizen Involvement Pol. Dec.
69.30 = T3 Openness in Govt.	77.41 = T11 Face-to-Face Communication	82.46 = T15 Citizen Part./Local Community
67.42 = T15 Citizen Part./Local Community	76.36 = T12 Civil Defense Communication	81.79 = T20 Cross-Cultural Communication
67.68 = T6 One-Way Communication	75.95 = T4 Citizen Information	80.48 = T19 Privacy
67.62 = T12 Civil Defense Communication	75.73 = T15 Citizen Part./Local Community	79.85 = T12 Civil Defense Communication
65.96 = T5 Two-Way Communication	75.39 = T5 Two-Way Communication	79.55 = T21 Societal Communication/Gen.
65.57 = T4 Citizen Information	72.89 = T6 One-Way Communication	79.16 = T3 Openness in Govt.
61.95 = T20 Cross-Cultural Communication	71.53 = T20 Cross-Cultural Communication	78.58 = T11 Face-to-Face Communication
61.00 = T21 Societal Communication/Gen.	70.74 = T21 Societal Communication/Gen.	76.68 = T6 One-Way Communication
60.85 = T16 Self-Expression	68.05 = T16 Self-Expression	75.53 = T10 Capital Invest./Comm. Infra.
51.05 = T8 Entertainment Communication	61.09 = T10 Capital Invest./Comm. Infra.	75.05 = T17 Education Communication
50.45 = T10 Capital Invest./Comm. Infra.	59.25 = T8 Entertainment Communication	74.29 = T16 Self-Expression
50.81 = T17 Education Communication	57.68 = T17 Education Communication	67.95 = T13 Electronic Message
50.80 = T22 Access to Means/Comm.	52.95 = T24 Anticipatory Skills Dev.	67.80 = T24 Anticipatory Skills Dev.
36.19 = T18 Serendipitous Communication	50.95 = T14 Small Group Communication	65.86 = T14 Small Group Communication
35.87 = T24 Anticipatory Skills Dev.	49.76 = T22 Access to Means/Comm.	64.60 = T1 Mobile Communication
32.70 = T7 Persuasive Communication	48.12 = T13 Electronic Message	63.75 = T8 Entertainment Communication
31.13 = T2 Security Communication	45.10 = T2 Security Communication	62.40 = T22 Access to Means/Comm.
29.95 = T14 Small Group Communication	43.90 = T1 Mobile Communication	59.25 = T2 Security Communication
29.60 = T1 Mobile Communication	39.00 = T18 Serendipitous Communication	41.11 = T18 Serendipitous Communication
29.58 = T13 Electronic Message	35.73 = T7 Persuasive Communication	39.80 = T7 Persuasive Communication
22.51 = T23 Monopolistic Control	24.10 = T23 Monopolistic Control	25.10 = T23 Monopolistic Control

COMMUNICATION SUPPLIES RANKING*

1976	1991	2006
76.20 = T7 Persuasive Communication	80.27 = T6 One-Way Communication	87.10 = T6 One-Way Communication
70.05 = T6 One-Way Communication	75.53 = T7 Persuasive Communication	79.05 = T8 Entertainment Communication
61.68 = T11 Face-to-Face Communication	68.60 = T8 Entertainment Communication	78.10 = T5 Two-Way Communication
57.20 = T8 Entertainment Communication	67.23 = T12 Civil Defense Communication	76.53 = T7 Persuasive Communication
52.92 = T5 Two-Way Communication	65.67 = T5 Two-Way Communication	76.20 = T12 Civil Defense Communication
52.20 = T9 Citizen Involvement Pol. Dec.	64.57 = T9 Citizen Involvement Pol. Dec.	73.42 = T9 Citizen Involvement Pol. Dec.
51.05 = T12 Civil Defense Communication	63.10 = T11 Face-to-Face Communication	73.00 = T1 Mobile Communication
44.57 = T23 Monopolistic Control	56.60 = T4 Citizen Information	72.92 = T21 Societal Communication/Gen.
41.20 = T19 Privacy	55.00 = T20 Cross-Cultural Communication	72.45 = T20 Cross-Cultural Communication
40.53 = T16 Self-Expression	54.16 = T16 Self-Expression	71.95 = T4 Citizen Information
40.40 = T21 Societal Communication/Gen.	52.62 = T1 Mobile Communication	68.39 = T17 Education Communication
40.13 = T15 Citizen Participation	52.05 = T19 Privacy	65.95 = T3 Openness in Govt.
38.83 = T20 Cross-Cultural Communication	51.76 = T10 Capital Invest./Comm. Infra.	65.80 = T10 Capital Invest./Comm. Infra.
38.22 = T10 Capital Invest./Comm. Infra.	51.32 = T21 Societal Communication/Gen.	64.58 = T2 Security Communication
37.73 = T18 Serendipitous Communication	51.20 = T3 Openness in Govt.	64.33 = T11 Face-to-Face Communication
37.54 = T3 Openness in Govt.	51.05 = T15 Citizen Part./Local Community	64.25 = T13 Electronic Message Flow
36.82 = T4 Citizen Information	49.75 = T23 Monopolistic Control	61.32 = T14 Small Group Communication
29.76 = T1 Mobile Communication	45.03 = T2 Security Communication	59.79 = T15 Citizen Part./Local Community
23.96 = T2 Security Communication	45.60 = T17 Education Communication	58.85 = T16 Self-Expression
23.30 = T22 Access to Means/Comm.	42.26 = T18 Serendipitous Communication	55.00 = T24 Anticipatory Skills Dev.
22.83 = T17 Education Communication	40.17 = T14 Small Group Communication	54.85 = T19 Privacy
20.45 = T24 Anticipatory Skills Dev.	39.19 = T24 Anticipatory Skills Dev.	54.05 = T22 Access to Means/Comm.
16.75 = T14 Small Group/Elect.	38.95 = T22 Access to Means/Comm.	53.75 = T23 Monopolistic Control
13.46 = T13 Electronic Message	38.65 = T13 Electronic Message	49.72 = T18 Serendipitous Communication

*Ranking by means.

STRENGTH OF COMMUNICATION RIGHT RANKINGS*

1976	1991	2006
85.80 = T12 CIVIL DEFENSE COMMUNICATION	87.05 = T22 CIVIL DEFENSE COMMUNICATION	88.25 = T22 CIVIL DEFENSE COMMUNICATION
82.57 = T9 CITIZEN INVOLVEMENT POL. DEC.	85.53 = T9 CITIZEN INVOLVEMENT POL. DEC.	87.86 = T9 CITIZEN INFORMATION
82.03 = T19 PRIVACY	85.31 = T6 ONE-WAY COMMUNICATION	87.65 = T6 ONE-WAY INFORMATION
81.86 = T3 OPENNESS IN GOVT.	84.89 = T4 CITIZEN INFORMATION	87.10 = T3 OPENNESS IN GOVT.
81.24 = T6 ONE-WAY COMMUNICATION	84.85 = T3 OPENNESS IN GOVT.	87.07 = T9 CITIZEN INVOLVEMENT POL. DEC.
80.72 = T4 CITIZEN INFORMATION	84.30 = T19 PRIVACY	85.50 = T19 PRIVACY
79.03 = T11 FACE-TO-FACE COMMUNICATION	82.05 = T11 FACE-TO-FACE COMMUNICATION	84.51 = T16 SELF-EXPRESSION
77.93 = T16 SELF-EXPRESSION	81.58 = T16 SELF-EXPRESSION	83.81 = T21 SOCIETAL COMMUNICATION/GEN.
76.85 = T15 CITIZEN PRNT./LOCAL COMMUNITY	80.50 = T15 CITIZEN PRNT./LOCAL COMMUNITY	83.43 = T15 CITIZEN PRNT./LOCAL COMMUNITY
76.06 = T20 CROSS-CULTURAL COMMUNICATION	79.62 = T21 SOCIETAL COMMUNICATION/GEN.	83.32 = T5 TWO-WAY COMMUNICATION
74.66 = T5 TWO-WAY COMMUNICATION	78.64 = T5 TWO-WAY COMMUNICATION	82.24 = T11 FACE-TO-FACE COMMUNICATION
73.81 = T21 SOCIETAL COMMUNICATION/GEN.	78.06 = T20 CROSS-CULTURAL COMMUNICATION	80.86 = T20 CROSS-CULTURAL COMMUNICATION
65.28 = T8 ENTERTAINMENT COMMUNICATION	67.16 = T8 ENTERTAINMENT COMMUNICATION	75.53 = T17 EDUCATION COMMUNICATION
58.50 = T10 CAPITAL INVEST./COMM. INFRA.	66.30 = T22 ACCESS TO MEDIA/COMM.	74.66 = T22 ACCESS TO MEDIA/COMM.
56.03 = T22 ACCESS TO MEDIA/COMM.	64.82 = T10 CAPITAL INVEST./COMM. INFRA.	70.74 = T24 ANTICIPATORY SKILLS DEV.
53.16 = T18 SCRAMBLED COMMUNICATION	63.36 = T17 EDUCATION COMMUNICATION	70.51 = T8 ENTERTAINMENT COMMUNICATION
51.56 = T24 ANTICIPATORY SKILLS	62.64 = T24 ANTICIPATORY SKILLS DEV.	68.78 = T10 CAPITAL INVEST./COMM. INFRA.
51.23 = T17 EDUCATION COMMUNICATION	57.18 = T14 SMALL GROUP COMMUNICATION	68.09 = T14 SMALL GROUP COMMUNICATION
43.31 = T14 SMALL GROUP COMMUNICATION	55.00 = T18 SCRAMBLED COMMUNICATION	64.32 = T13 ELECTRONIC MESSAGE
42.64 = T7 PERSUASIVE COMMUNICATION	54.28 = T13 ELECTRONIC MESSAGE	62.65 = T1 MOBILE COMMUNICATION
41.00 = T2 SECURITY COMMUNICATION	51.87 = T1 MOBILE COMMUNICATION	58.63 = T2 SECURITY COMMUNICATION
38.75 = T13 ELECTRONIC MESSAGE	50.07 = T2 SECURITY COMMUNICATION	56.46 = T18 SCRAMBLED COMMUNICATION
36.93 = T1 MOBILE COMMUNICATION	49.54 = T7 PERSUASIVE COMMUNICATION	49.24 = T7 PERSUASIVE COMMUNICATION
24.24 = T23 MONOPOLISTIC CONTROL	25.79 = T23 MONOPOLISTIC CONTROL	29.10 = T23 MONOPOLISTIC CONTROL

*Ranking by means.

I do not think that one could conclude from the data that these lists are in exact order from highest to lowest need, supply, or right. However, I think that it is reasonable to conclude that the top five or ten are of higher manuscript (in the case of need and right) or availability (for supply) than the bottom five or ten. Given limited resources in policy and planning for communication in the State, it would be reasonable to take action in the form of either research, or policy and planning decisions on the top ranking concepts before taking action on the bottom ranking concepts.

THE POLICY URGENCY INDEX

The following equation was used to determine which concepts were most "out of balance" in respect to supplies meeting needs as weighted by rights.

$$(NEEDS-SUPPLY) \times \text{STRENGTH OF RIGHT} = \text{POLICY URGENCY}$$

Simply stated, the need level minus the supply level leaves a quantity which is either an unmet or over-met communication need. This quantity multiplied by the strength of the right yields a quantity called the Policy Urgency Index (PUI). The rank order of each of these PUI quantities provides an indication of which of the concepts are most "out of balance" when weighted by human rights. The rankings for 1976, 1991, and 2006 are as follow:

DISCUSSION OF IMBALANCE-ORIENTED ISSUES

In order to exemplify how the PUI is useful in pointing out potential "imbalance-oriented" issues, the following sections will provide discussions on the top three ranking 1991 concepts.

PRIVACY

Defined as the control over information concerning oneself, privacy is, and will continue to be an important policy issue for the next 15-30 years. Both the need and right to privacy was projected to be very high and rising only slightly over the forecast period, while the 1976 supply was forecasted as low and increasing slightly.

POLICY URGENCY INDEX RANKINGS*

2005	2006	2007
2005.00 = T3 OWNERSHIP IN GOVT.	2297.3 = T19 PRIVACY	2218.3 = T19 PRIVACY
2802.8 = T19 PRIVACY	2294.7 = T3 OWNERSHIP IN GOVT.	2054.7 = T7 PERSUASIVE COMMUNICATION
2159.2 = T4 CITIZEN INFORMATION	1985.95 = T15 CITIZEN PRVT./LOCAL COMM.	1891.95 = T15 CITIZEN PRVT./LOCAL COMM.
2128.2 = T15 CITIZEN PRVT./LOCAL COMM.	1971.89 = T7 PERSUASIVE COMMUNICATION	1305.9 = T16 SELF-EXPRESSION
1845.4 = T9 CITIZEN INVOLVEMENT POL. DEC.	1640.9 = T4 CITIZEN INFORMATION	1203.6 = T4 CITIZEN INFORMATION
1756.9 = T23 CROSS-CULTURAL COMMUNICATION	1546.22 = T21 SOCIETAL COMMUNICATION/GEN.	1171.92 = T11 FACE-TO-FACE COMMUNICATION
1509.9 = T7 PERSUASIVE COMMUNICATION	1304.3 = T9 CITIZEN INVOLVEMENT POL. DEC.	1149.72 = T3 OWNERSHIP IN GOVT.
1501.97 = T16 SELF-EXPRESSION	1212.27 = T20 CROSS-CULTURAL COMMUNICATION	1079.5 = T8 ENTERTAINMENT COMMUNICATION
1500.4 = T21 SOCIETAL COMMUNICATION/GEN.	1176.85 = T11 FACE-TO-FACE COMMUNICATION	913.3 = T6 ONE-WAY COMMUNICATION
1400.8 = T12 CIVIL DEFENSE COMMUNICATION	1174.4 = T16 SELF-EXPRESSION	905.47 = T24 ANTICIPATORY SKILLS DEV.
1065.3 = T11 FACE-TO-FACE COMMUNICATION	892.10 = T17 EDUCATION COMMUNICATION	855.02 = T9 CITIZEN INVOLVEMENT POL. DEC.
973.6 = T5 TWO-WAY COMMUNICATION	862.55 = T24 ANTICIPATORY SKILLS DEV.	833.75 = T23 MONOPOLISTIC CONTROL
868.16 = T22 ACCESS TO PLANS/COMM.	793.23 = T10 CAPITAL INVEST./COMM. INFRA.	756.8 = T20 CROSS-CULTURAL COMMUNICATION
818.6 = T17 EDUCATION COMMUNICATION	791.85 = T12 CIVIL DEFENSE COMMUNICATION	669.22 = T10 CAPITAL INVEST./COMM. INFRA.
801.2 = T24 ANTICIPATORY SKILLS DEV.	760.4 = T5 TWO-WAY COMMUNICATION	656.3 = T17 EDUCATION COMMUNICATION
715.4 = T10 CAPITAL INVEST./COMM. INFRA.	716.04 = T22 ACCESS TO PLANS/COMM.	622.66 = T22 ACCESS TO PLANS/COMM.
572.1 = T14 SMALL GROUP COMMUNICATION	699.70 = T23 MONOPOLISTIC CONTROL	555.6 = T21 SOCIETAL COMMUNICATION/GEN.
574.7 = T23 MONOPOLISTIC CONTROL	647.50 = T6 ONE-WAY COMMUNICATION	525.0 = T1 MOBILE COMMUNICATION
430.9 = T13 ELECTRONIC MESSAGE	629.28 = T8 ENTERTAINMENT COMMUNICATION	406.1 = T18 SCHEMATIC COMMUNICATION
410.8 = T8 ENTERTAINMENT COMMUNICATION	615.25 = T14 SMALL GROUP COMMUNICATION	400.76 = T5 TWO-WAY COMMUNICATION
295.97 = T2 SECURITY COMMUNICATION	514.05 = T13 ELECTRONIC MESSAGE FLOWS	322.92 = T12 CIVIL DEFENSE COMMUNICATION
190.9 = T6 ONE-WAY COMMUNICATION	462.3 = T1 MOBILE COMMUNICATION	311.91 = T2 SECURITY COMMUNICATION
189.45 = T1 MOBILE COMMUNICATION	179.3 = T18 SCHEMATIC COMMUNICATION	309.1 = T14 SMALL GROUP COMMUNICATION
81.85 = T18 SCHEMATIC COMMUNICATION	3.5 = T2 SECURITY COMMUNICATION	236.6 = T13 ELECTRONIC MESSAGE

*Ranking by (Need-Supply) x Right.

The evolving privacy problem is most identified with centralized electronic data systems that are increasingly capable of maintaining and distributing personal information. The threat of improperly used or incorrect personal information are central concerns of privacy policy matters. In the second round discussion, participants anonymously indicated that the "courts themselves are unclear on what should or should not be divulged" and that "social welfare" programs will contribute to the loss of personal privacy.

Representing a different perspective on the issue, one participant argued that "as the ability to monitor everything grows, it may well be accompanied with the realization that if we all know everything about each other, then it does not really matter who knows what--we may well become a 'small town' in this sense."

The U. S. federal government has responded to this evolving policy problem by passing the 1974 Privacy Act, by establishing a Domestic Council on the Right to Privacy, and by conducting several senate hearings and issuing reports. Actions concerning limitations of personal information disclosure, inspections and correction of personal files have been taken. Excluding credit information, these actions have not addressed privacy issues with respect to collecting information in the private sector where many policy questions concerning access, limitations, and rights will remain to be addressed.

Areas of research and data collection should include those concerning credit records, medical and insurance records, employment and personnel records, banking and financial records, extended use of social security numbers, State information laws, and the like.

Future privacy policies will need to address such problems as use and abuse of personal data, standards for accuracy and bias of captured and transferred information, data havens, mechanisms to monitor and correct improprieties, etc. As information is increasingly viewed as the currency in the communication era, the collection, storage, and distribution of this valuable resource will no doubt be the subject of much policy debate and action.

OPENNESS IN GOVERNMENT

Defined as open, prepared, and posted agendas and the provision for citizens to attend all government meetings, openness in government is not entirely unrelated to the privacy issue. Forecasts for this concept reflected a high and rising need, a high and relatively stable right, and a low and somewhat rising supply. Imbalances between need and supply are forecasted to decrease somewhat over the next thirty years, although openness in government still remains in the top ten most imbalanced issues in 2006.

The participants' discussion on this issue reflected concern that although the state of Hawaii has a "sunshine law," people do not necessarily know of its existence and do not take full advantage of it. There are "fewer" secret meetings under "sunshine," but the problem is now one of logistics, that is, where and when the meetings are held. Statements concerning (or questioning) a citizen's need to know about all government meetings, and the need for citizens to selectively choose areas of interest and concern were also discussed. The supply problem of "openness in government" concerns providing the means on a selective and equitable basis for access to government proceedings. "Congressional history," as one participant points out, "has shown a need for non-public meetings if work is to be done." Another points out that "all government meetings cannot and shall not be open to the public."

Polarization on this issue is already occurring. Some of the policy problems to be addressed will concern such issues as degree and implementation of governmental openness, privacy rights of those serving in the government, equitable mechanisms for opening participation to all socioeconomic levels, access to government records, logistics of meetings, and relative costs of openness and closedness in government.

As the Policy Urgency Index indicated, the issue of openness is one which will no doubt require considerable policy attention in the next 15 years. Those advocating individual rights of access and participation will be confronted with arguments of national or state security and efficiency. Alternatives for providing wider access to, or openness of, government will no doubt look to such alternatives as television, telephone polling, and wider access to federal or state data bases. Implementing these alternatives (or others) will necessitate open debate, tradeoffs, and policy decisions, all of which require a broader understanding of this complex issue.

CITIZEN PARTICIPATION IN LOCAL COMMUNITY

This high-ranking 1991 issue addresses social and cultural interactions of people that results in promoting a sense of community or neighborhood. Although this issue does not totally exclude the previous concerns for openness in government and privacy, it focuses on participation at a local level and can be viewed more in social or cultural terms than political. The need and right forecasts for this concept were significantly higher than the projected supply levels. Problems pointed out in the participants' comments involved the real or potential reduction of community interaction by electronic communication media and that few channels exist by which neighborhood people can be drawn together. Participants indicated that technology promotes "no physical presence" and "spreads social fear" which actually inhibits people from contacting each other.

In contrast, others point out that people are not necessarily interested in participating in local community, even if the means were available. Comments were offered that two-way systems would promote social interaction, but that this interaction would not necessarily be locally-oriented. Some participants felt that future social interactions would be oriented toward common or professional interests and be state or national in scope.

The real issues here may be the identification, accessibility, and connectability of people holding particular common interests. New "tele-communities" may evolve that do not conform to previous definitions of "local" or "neighborhood." This development is highly dependent upon the configurations of electronic communication networks and costs. Issues concerning who will provide, control, and profit from these networks will no doubt arise and will require state and federal decisions, the scope of which will affect the very fabric of Hawaii's future society.

In summary, the PUI is the mechanism that can be used to indicate priorities for research or data collection which, in turn, should indicate what specific policy or planning actions should be taken. The PUI reduces uncertainty by providing an "early warning" of potential problems before crises occur. In this regard, it serves the requirements of a feedforward control system.

THE DYNAMICS INDEX

The final index developed concerned the dynamics of each concept need, supply, and right over time. By subtracting the 1976 level from the projected 2006 level, a growth index can be derived. The equations are as follow:

$$\text{NEEDLEVEL 1976} - \text{NEEDLEVEL 2006} = \text{NEEDSGROWTH}$$

$$\text{SUPPLYLEVEL 1976} - \text{SUPPLYLEVEL 2006} = \text{SUPPLYGROWTH}$$

$$\text{RIGHTSLEVEL 1976} - \text{RIGHTSLEVEL 2006} = \text{RIGHTSGROWTH}$$

$$\text{NEEDSGROWTH} + \text{SUPPLYGROWTH} + \text{RIGHTSGROWTH} = \text{DYNAMICS INDEX (DI)}$$

The dynamic index provides an indication of which concepts will exhibit the most growth over time and, therefore, are most likely to require policy and planning attention. The dynamics rankings are as follow:

DYNAMIC INDEX RANKINGS*

1976	SUPPLY	RIGHT	1991 04/90
45 = T13 ELECTRONIC MESSAGE FLOW	51 = T13 ELECTRONIC MESSAGE	26 = T13 ELECTRONIC MESSAGE	120 = T13 ELECTRONIC MESSAGE
38 = T11 MOBILE COMMUNICATION	45 = T14 SMALL GROUP COMMUNICATION	26 = T11 MOBILE COMMUNICATION	108 = T11 MOBILE COMMUNICATION
37 = T17 EDUCATION COMMUNICATION	44 = T17 EDUCATION COMMUNICATION	25 = T14 SMALL GROUP COMMUNICATION	106 = T14 SMALL GROUP COMMUNICATION
36 = T14 SMALL GROUP COMMUNICATION	43 = T11 MOBILE COMMUNICATION	24 = T17 EDUCATION COMMUNICATION	105 = T17 EDUCATION COMMUNICATION
32 = T24 ANTICIPATORY SKILLS DEV.	41 = T2 SECURITY COMMUNICATION	19 = T24 ANTICIPATORY SKILLS DEV.	86 = T2 SECURITY COMMUNICATION
28 = T2 SECURITY COMMUNICATION	35 = T4 CITIZEN INFORMATION	18 = T22 ACCESS TO PLANS/COMPL.	85 = T24 ANTICIPATORY COMM.
25 = T7 CAPITAL INVEST./COMM. IMPROV.	35 = T24 ANTICIPATORY SKILLS DEV.	17 = T2 SECURITY COMMUNICATION	75 = T22 ACCESS TO PLANS/COMPL.
24 = T22 ACCESS TO PLANS/COMPL.	34 = T20 CROSS-CULTURAL COMM.	10 = T21 SOCIETAL COMMUNICATION/COMM.	64 = T4 CITIZEN INFORMATION
22 = T4 CITIZEN INFORMATION	32 = T21 SOCIETAL COMMUNICATION/COMM.	10 = T10 CAPITAL INVEST.	62 = T10 CAPITAL INVEST./INFRA.
20 = T20 CROSS-CULTURAL COMM.	31 = T22 ACCESS TO PLANS/COMPL.	9 = T5 TWO-WAY COMMUNICATION	60 = T21 SOCIETAL COMMUNICATION/COMM.
18 = T21 SOCIETAL COMMUNICATION/COMM.	28 = T3 OPENNESS IN GOVT.	7 = T4 CITIZEN INFORMATION	58 = T20 CROSS-CULTURAL COMMUNICATION
18 = T5 TWO-WAY COMMUNICATION	27 = T10 CAPITAL INVEST./COMM. IMPROV.	7 = T7 PERSUASIVE COMMUNICATION	53 = T5 TWO-WAY COMMUNICATION
15 = T6 ONE-WAY COMMUNICATION	26 = T5 TWO-WAY COMMUNICATION	7 = T16 SELF-EXPRESSION	44 = T3 OPENNESS IN GOVT.
15 = T15 CITIZEN PART./LOCAL COMM.	25 = T12 CIVIL DEFENSE COMMUNICATION	7 = T19 PRIVACY	41 = T15 CITIZEN PARTICIPATION
14 = T16 SELF-EXPRESSION	22 = T8 ENTERTAINMENT COMMUNICATION	6 = T3 OPENNESS IN GOVT.	40 = T12 CIVIL DEFENSE COMMUNICATION
12 = T8 ENTERTAINMENT COMM.	21 = T9 CITIZEN INVOLVE. POL. DEC.	6 = T6 ONE-WAY COMMUNICATION	39 = T16 SELF-EXPRESSION
12 = T12 CIVIL DEFENSE COMM.	19 = T15 CITIZEN PARTICIPATION	5 = T8 ENTERTAINMENT COMMUNICATION	39 = T8 ENTERTAINMENT COMMUNICATION
10 = T3 OPENNESS IN GOVT.	18 = T16 SELF-EXPRESSION	5 = T25 MONOPOLISTIC CONTROL	38 = T6 ONE-WAY COMMUNICATION
9 = T9 CITIZEN INVOLVE. POL. DEC.	17 = T6 ONE-WAY COMMUNICATION	5 = T9 CITIZEN INVOLVE. POL. DEC.	35 = T9 CITIZEN INVOLVE. POL. DEC.
8 = T9 PRIVACY	13 = T19 PRIVACY	4 = T20 CROSS-CULTURAL COMM.	24 = T19 PRIVACY
5 = T18 SENSIBILITIES COMM.	12 = T18 SENSIBILITIES COMM.	3 = T18 SENSIBILITIES COMMUNICATION	20 = T18 SENSIBILITIES COMMUNICATION
3 = T11 FACE-TO-FACE COMMUNICATION	6 = T7 PERSUASIVE COMMUNICATION	3 = T11 FACE-TO-FACE COMMUNICATION	15 = T7 PERSUASIVE COMMUNICATION
3 = T25 MONOPOLISTIC CONTROL	5 = T25 MONOPOLISTIC CONTROL	3 = T19 PRIVACY	13 = T25 MONOPOLISTIC CONTROL
2 = T7 PERSUASIVE COMMUNICATION	3 = T11 FACE-TO-FACE COMMUNICATION	3 = T12 CIVIL DEFENSE COMMUNICATION	9 = T11 FACE-TO-FACE COMMUNICATION

*Ranking by Unit of Change over time 1976-2006.

DISCUSSION OF GROWTH ISSUES

In order to examine the utility of the Dynamics Index (DI), the following sections will describe some of the possible problems and policy considerations that may be associated with three of the most dynamic 1991 communication concepts.

ELECTRONIC MESSAGE FLOW

Electronic message flow ranked highest in need, supply, and right shifts over the next thirty years. This broad concept involves such services as electronic mail, electronic funds transfer, and a host of other network information services.

In the last decade, a number of trends have set the stage for these rapidly growing areas. The declining costs of computer processing and memory have and will continue to give rise to new electronic business and home services. Paralleling and accelerating this growth is the rising availability of data communication services which have also declined in cost, while showing dramatic increases in availability, capacity, and reliability. As indicated by the Dynamics Index, the stage is set for rapid growth in this relatively recent communication development. The most obvious issues arising from this rapidly accelerating needs, supply, and rights growth are those associated with electronic mail and electronic funds transfer.

Electronic mail was the most discussed topic in the participants' second round justification statements. The increasing costs of energy and labor are seriously impacting traditional mail services. Electronic data and image distribution are already reducing traditional mail volumes and are projected to increase dramatically over the next 30 years. Although obviously not confined to a state issue, electronic mail holds especially important economic and social implications for the state of Hawaii.

Initially, the issue will concern who will offer these new electronic mail services. Should the U. S. Postal Service supply all, part, or none of the service? Should, as some suggest, private carriers assume the responsibilities, capital investment, and risk of these new services? Once settled, what mechanisms or standards must be established that will assure privacy, equity, and universality of service at a fair cost? What combina-

tion (configurations) of services could (should) be offered? In the initial stages, should the mail be handled electronically between major nodes of a network with local delivery left to postal carriers, or should it be universally delivered point-to-point by electronic home and office terminals? What of the unemployment and hardware costs attached to the latter option? These and other policy questions will no doubt confront policy makers in the next 15-30 years.

Electronic banking procedures and funds transfers are increasingly being adopted by banks, savings and loans, credit bureaus, and merchandising outlets. Whether this means a checkless/cashless society remains to be seen and is dependent upon a number of macro-policy decisions. What is most probable is that citizens will experience fewer check and cash transactions due to electronic funds systems, point of sale terminals, automatic tellers, and automatic clearinghouses.

This creates the need for establishing policy guidelines and regulations that will address such issues as competition, accessibility of credit information, privacy, and security in these new electronic financial systems.

Although the PUI did not indicate imbalances in electronic message flows (for example, the needs/supply/ and right were forecasted as moving in accordance with each other), the projected rapid growth of electronic message flow make it an extremely likely policy era. Research and data collection activity should be initiated before these complicated issues become critical and policy decisions are required.

MOBILE COMMUNICATION

This highly dynamic concept involves such services as marine and aircraft communication, two-way voice and data terminals connected via telephone networks and located in pocket or vehicle, personal paging, mobile facsimile, etc. The forecasts for growth in these areas can be treated as a "technologically driven future." That is, the need and right followed slightly behind the forecast for the supply over the 38 year period. Widespread future use of non-stationary means to communication was viewed by the participants as corporate- rather than consumer-oriented. Police and other emergency services (along with marine and aircraft usage) were indicated as having "genuine needs" although it was mentioned that personal communication needs, now satisfied by the telephone, will be met by small "personal communicators" by 2006.

The widespread introduction and utilization of mobile radio-telephone will create the need for developing other spectrum resources, or become much more efficient in using the present one. This requires extensive systems studies and networking expertise and may involve the difficult policy decision of reallocating present broadcast spectrum for mobile use.

Although not specifically mentioned by the participants, direct broadcast satellite, accompanied by more efficient spectrum use, may provide a viable alternative to serving land-based mobile systems. This is already proving to be useful in marine and air mobile communication. In the longer term, alternatives such as shifting to broadband optical fiber networks for television, radio, and video telephones may release a significant amount of spectrum space for mobile use.

Obviously, any shift of this scope would require appropriate state and federal policy action and would most certainly be dependent upon actions and agreements made at the World Administrative Radio Conference (WARC) in 1979.

In summary, the DI has indicated rapidly shifting needs, supplies, and rights with respect to mobile communication over the next 30 years. Policy action in this regard requires understanding complex social, economic, and technological tradeoffs. It is in the best interest of the citizens of Hawaii that information bases be established that can assist in these likely policy decisions.

SMALL GROUP COMMUNICATION

We have defined small group communication as 3-20 persons that are electronically-interposed via computer, telephone, or video links. This concept can be generally regarded as "teleconferencing" and is dependent upon available systems, techniques, transportation costs, training, and other psychological and social variables. The available supply was seen by the participating experts as dependent upon decreasing costs and capabilities of electronic equipment, combined with advanced communication skills.

In the shorter term, that is, in the next 15 years, the most widely used teleconferencing techniques will most likely involve voice, computer, and video respectively. Each of these forms have distinct advantages and limitations and require differing policy guidelines, technological configurations, cost structures, and skills. One often mentioned advantage of each teleconferencing medium is the potential for relatively large-scale substitution of communication for increasingly expensive, and many times non-essential, transportation.

Widespread adoption of teleconferencing will no doubt be affected by the costs and availability of alternative modes of communication/transportation, and as well by the degree that dehumanizing factors can be overcome in hardware and software design. The office of the future will be increasingly characterized by electronically-linked individuals working in decentralized locations. Once again, it is in the best interest of the state of Hawaii to compile policy-oriented data and research in order to prepare for these difficult, but likely policy developments.

The DI is an important indicator of potential policy problems associated with rapid growth. The more dynamic a concept (for example, the higher the change/unit of time), the less lead-time there is available to correct an evolving crisis situation. Therefore, those areas reflecting high overall dynamics rankings require greater monitoring. It is this alerting function, provided by the Dynamics Index, that reduces some of the uncertainty in the communication policy and planning process.

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PART 4 Urban and Regional Planning Methodology: Lessons for Communication Planning

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John Holmstrom

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INTRODUCTION

The purpose of this report is to review, for communication specialists, some of the methodological developments in the field of urban and regional planning in the hope that some lessons learned there can be applied to communication planning. There are two problems in such a review: first of all, it is not possible to summarize succinctly what urban and regional planning is, much less to summarize the recent methodological experiences in the field; and secondly, my own familiarity with communication planning is limited.

It must be evident to even a casual observer of urban and regional affairs that conscious planning activity, where it occurs, is conducted at the policy, program, and project levels and by a wide variety of people, not all of whom are "planners" by either profession or intent. The city councilman, the traffic engineer, the zoning board, the city planner, and the countless others in some way strongly influence urban and regional planning. The planner himself may simply aid these others in making "planning" decisions. Thus, it is not possible to describe the methods of a single homogeneous group of professionals and say, "that is how planners do things."

I was invited to write this report because of my familiarity with urban and regional planning methods, and not for my knowledge of the field of communication. It is my belief that there is significant potential for transferring methods from urban and regional planning to communication planning, and that this examination of methods can lead to a more efficient development of the communication planning field.

CHAPTER 1: URBAN AND REGIONAL PLANNING

SCOPE OF THE FIELD

Historically, urban planning was essentially "architecture writ large," with an emphasis on physical layout of the urban pattern and the design of public improvements (including public buildings, thoroughfares, and parks). That concept of urban planning may have been appropriate for the times, given accepted assumptions about the role of government in a community's activities (a small role compared with that of today) and different beliefs about the significant environmental factors which determined a community's welfare (an emphasis on physical determinants).

While physical planning is still an important aspect of urban planning, the domain of the field has broadened greatly. The purpose remains the same--to improve the welfare of a community's residents. However, the concept of community welfare has expanded to such an extent, along with the list of determinants of that welfare, that urban planning has become a broad and diverse field concerned not only with the provision of services and physical facilities, but also with local fiscal policies and the governance of all types of activities through laws and regulations.

This range of activities occurs at the project, program, and policy levels. An examination of these terms from the perspective of urban and regional planning might be useful to the communication planner. We will refer to a project as a single action or undertaking intended to achieve some objective or objectives. This may entail the construction of a single structure, such as a bridge, but may also be the adoption of a single piece of legislation, or any other single action. A program is a set of actions (or interrelated projects) intended to achieve some set of objectives. One attribute of programs is that they are generally effected over time, rather than being "one-shot" efforts.

The concept of policy is much more elusive. Since the term is frequently used by communication specialists (for example, "communication policy planning"), it deserves more elaboration here. On the one hand, it refers to prescriptive, guiding statements such as: "It shall be the policy of this agency to hire a representative number of women." Generally, such policy statements do not have the force of law, but that is just as well, since such general statements can sometimes be in conflict when applied to particular situations and must necessarily be circumvented. For example, one policy to protect the environment and another to reduce unemployment may be in conflict when the topic for consideration is a new labor-intensive, polluting industry. Statements of this type are essentially general expressions of values, and such values are frequently traded off and modified over time. Policy of this type will be termed "policy-as-value."

A second type of prescriptive policy is the decision making criterion, as established by law, rule, or regulation. Examples are numerous: "There shall be no construction within forty feet of the shoreline, as determined by the upper reach of the wash of the waves"; "there shall be at least one teacher for every twenty-five elementary school students"; and so on. Such standards are fairly specific and unambiguous. Their enforcement can usually be sought through administrative or judicial channels. We will term this type of policy "policy-as-criterion." The political structure must sanction this type of policy; it is visible; it is relatively incapable of being comprised. But it is also too specific to be a general guide to action, as is policy-as-value.

The third way in which the term "policy" is used is less precise. Sometimes the components of a program, consisting of a variety of actions including regulations and construction projects, are said to be "policy." In this context, "policy" may be considered to be synonymous with "programmatic decisions." In general, it is useful to avoid using the term "policy" in this manner.

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The fourth type of policy statement is descriptive rather than prescriptive. It is derived by looking back at actions that have been taken and summarizing their common attributes. It is a determination of implicit criteria that were employed in decision making. For example, "the zoning board has (implicitly) discriminated against the small land owner/developer and [acted] in favor of the large land owner/developer"; or "there has been a systematic bias against the hiring of women by this agency of government." In terms of altering future decision making it can be useful to understand the implicit policies that have been exercised in the past, even if it is clear that attitudes, and not laws, require changing.

This report will concentrate on program planning, with some extension to policy planning, for the following reasons:

Project planning will not be considered because it is principally a matter of effectuating a decision that has already been made. Generally, the decision to act (for example, to raise a community's property tax) is based on broader programmatic needs; program planning will point to the appropriateness of the increased property tax (if that is the case); how the property tax increase is put into effect is a technical matter to be left to the specialist.

Prescriptive policy statements are useful to the extent that they have a programmatic basis; that is, to the extent that they are viewed as means toward some desired ends. Both "policy-as-value" and "policy-as-criterion" statements can be viewed as outcomes of program planning efforts, at least if such statements are to have a logical basis.

Implicit policy statements (those determined after-the-fact) are revealed by evaluating past action and will therefore be discussed in the section on ex post evaluation.

A GENERAL DEFINITION OF PLANNING

Generalizations about the planning process reflect two things: (1) the broadening conception of what urban and regional planning is, as a field; and (2) the recognition that there are some attributes of planning as a deliberate process that have relevance to many spheres of activity, including communications. Planning is defined here in a way that will permit its adaptation to a variety of contexts.

Planning is the deliberate determination of a course of action which involves intervening in a process in order to promote the desired consequences of that process.

The elements of this definition are important. Planning is ultimately concerned with the consequences of actions, and not with the actions themselves. Another way of saying this is that it is not so important what we do, but rather what the results are. In systems terms, it is the "outputs" that are significant, not the "inputs."

Generally, we are able only to promote a desired consequence, that is, to move in the right direction (if at all). There are few problems confronting the urban and regional planner that can be solved outright; but we can at least attempt to mitigate them.

Planning is a deliberate process which can be applied to a wide variety of situations. Of course, this is an idealized statement. Much work done by people labeled as "planners" shows little of the rigor that is implied in our definition. This will become more evident in the section to follow.

Planners must recognize the processes (social, environmental, economic, etc.) that are operating and examine the ways in which the forces and elements in these processes might be influenced in order to produce desired outcomes. For example, let us use the environmental problem of poor water quality as an example. If a reduction in siltation in some body of receiving water is desired, how can the activities of governmental regulatory agencies and land developers be modified so that there is less soil erosion, or it is trapped before it enters the receiving water? Can new laws or regulations accomplish this? Would more personnel or enforcement help? What about construction of sediment traps? Many alternatives are available. To be an effective planner requires knowledge of (or access to knowledge of) many systems.

A PARADIGM OF THE PLANNING PROCESS

In his part of this volume, "Communication Policy and Planning," Dan J. Wedemeyer expands on the systems approach to planning. The elements of that approach have been reported frequently in the urban and regional planning literature; for example, in Krueckeberg and Silvers (1974), Lapatra (1973), Stuart (1976),

and Kraemer (1973).

It is essential at this point in our discussion to comment briefly on the systems approach to planning, since some of its essential features are so poorly reported in the literature, and because violation of them seriously compromises the effectiveness of the entire planning effort. The suggestions given here are based on urban and regional planning experience, but their applicability to communication planning is readily apparent.

The overall planning process is the framework for all planning method. Specific planning techniques have uses at prescribed points in the process. The sections that follow should show the diverse requirements placed on planning methodology and methodologists.

PROBLEM IDENTIFICATION

Perhaps the most important step in the planning process is identification of the problem. While this step appears trivial at first glance, experience has proven otherwise. In fact, it is probably the exception if problems are identified in such a manner that they lead to effective planning in subsequent stages.

A problem statement should specify the adverse consequences of a process. For example, in the transportation planning context an appropriate problem statement might be: "congestion during peak commuting hours in a specific portion of a highway"; or, "high levels of nitrogen oxides in the air during certain seasons of the year." This emphasis on consequences of the transportation process (or outputs of the system) is distinguished from another common (but less useful) form of problem statement which speaks of problems in terms of processes or in terms of inputs to the process. For example, a process-oriented statement would be: "people commute alone in their cars too much" (the process here is commuting). The act of commuting by itself is not deleterious, but some of its consequences are (for example, accidents and congestion). That is, the process is a contributory factor leading to a number of problems. This distinction between causes and consequences is important to planning. If we were to recognize a process as a problem (for example, a single-passenger commuting), then there may be only one solution to that problem--getting more people to commute in carpools or diverted to some other mode of transportation. If we accept the consequence as the problem (for example, congestion), we open up many more possible means of problem mitigation, including the option of changing commuting practices but also including very different types of change, such as staggering working hours.

The important point is that a problem (in general) has multiple causes. The significance of the problem identification stage of the planning process is to state the problem in such a way that it permits the consideration of multiple causes and, hence, multiple approaches to problem reduction.

Another limiting approach to problem identification occurs if one accepts a statement which specifies the inputs to a process. Again using the transportation example, it is of limited usefulness to accept statements such as the following: "the problem is that we don't have enough buses"; or, "the problem is that we have too many cars on the road." Buses and cars are inputs to the transportation process, but statements such as these restrict our thinking about the whole problem; they beg the "solution." The skeptic can argue easily against such "prescriptive" problem statements as follows: "buses are dirty and noisy and car manufacture provides employment, so we need fewer buses and more cars." Such an argument may not gain much agreement, but it nevertheless makes a good point: the consequences of transportation processes (dirt and noise of buses, congestion, energy waste, the employment contribution of automobiles, etc.) deserve the principal focus.

One of the fundamental purposes for specifying problems in terms of consequences is that it ultimately leads to a consideration of alternative solutions. If there is one hallmark of planning methodology that has general agreement, it is that planners should think in terms of alternatives. Stating a consequence as a problem logically leads to a consideration of the causes of the consequences. The other forms of problem statement, particularly the input-oriented problem statement, lead to narrow viewpoints. There is more than one way to reduce congestion or air pollution; "there is more than one way to skin a cat." Unfortunately, too many planners do not recognize the importance of correctly formulating problem statements, and thereby limit the vision of their clients when it comes to recommending action. It is natural for politicians and other decision makers to be action-prone. They are accustomed to making ultimate decisions and to getting the credit for their accomplishments. One of the planner's most critical duties is to intervene in decision processes; by helping his client to specify what he really wants to accomplish (in terms of consequences) before committing himself to a particular action, he can direct the decision making process toward being open-minded and, ultimately, more effective.

UNDERSTANDING THE SYSTEM

The systems with which we are dealing encompass cause-and-effect relationships: inputs and processes combine to produce outputs or consequences. Planning identifies alternative ways of modifying these outputs. This is accomplished by making the relevant system understandable, by "modeling" it. This requires placing

bounds on the system by identifying the relevant entities of the bounded system and by specifying the relationships of the process which relate those entities.

The critical first step in specifying a system is the establishment of indicators of the problem. Indicators are descriptive statistics which can be used to demonstrate the existence of a problem. The following are examples: parts per million of carbon monoxide in the atmosphere; infant mortality rate in a population; the ratio of actual to "ideal" commuting time, aggregated for a commuting population. Once the problem indicator is specified, it is a matter of experience (knowledge) and judgment to derive the relevant contributory system. No single model of the system is "correct"; rather, alternative models are "more or less useful". Modeling is a creative process.

The system model that is initially identified will usually contain a number of hypotheses relating entities in the system. If decision making is to be done on the basis of "faith," there is no need to further test these hypotheses. In actual practice this is frequently the case. This approach might appropriately be termed "decision making based on wishful thinking." This approach employs leaps of faith which relate action to desired consequence without empirical or even theoretical justification. For example, "Let's establish this transportation system because it will result in population dispersal away from the congested core city." Or, "Let's put in this mass transit system because it will get people out of their cars." Under certain circumstances those conclusions may prove correct, but all too often actions are proposed without a full consideration of reasonable results.

GENERATING ALTERNATIVES

Once there is an understanding of the system which contributes to a problem, it is usually possible to identify more than one way of intervening in the system in order to modify its problematic consequences. For example, certain types of air pollution can be reduced by reducing industrial emissions (through the use of air scrubbers, for example) or vehicle emissions (through a variety of actions including retro-fitting older vehicles with air pollution control devices and maintaining such devices in proper order where they exist). This stage provides a good test for the problem statement and the system model, which were previously specified. If the model suggests only a single means of reducing the problem, it may be that the problem statement is faulty, or insufficient thought was given to modelling the system. If such is the case, those steps should be retraced until a set of alternative problem-mitigating actions is suggested.

ASSESSING ALTERNATIVES

It goes without saying that we should "look before we leap"; that is, we should predict the consequences of our actions if we do not want to be surprised and perhaps disappointed later. This stage in the process is reflected in environmental impact statements, cost-benefit analysis, and many other related methods. Actions have multiple consequences, and prior consideration should be given to them.

As obvious and important as this stage is, it is frequently undermined. Alternatives are sometimes assessed differentially; biases are frequently interjected, with some alternatives discussed only in terms of their advantages, and others in quite different terms. Assessment of alternatives must evaluate in a similar fashion all the alternatives under consideration.

No alternative should be assessed until other alternatives are generated. This is a prescription that is almost universally abused, or of which most planners are unaware. How frequently do we see the single idea which is grasped as the solution to a problem and which is then both supported and attacked by growing choruses of supporters and detractors? For example, "What we need is a mass transit system." With such a statement comes a chain of debate, a solidification of points of view, and ego-involvement that cannot be overcome. When such a situation occurs, opportunities for reasoned planning have been foregone and are unlikely to reappear. The way to avoid solidification of thinking is to force the consideration of alternative actions prior to the assessment of any of the alternatives. To do so runs counter to people's inclinations; it is common to find people ready to jump to conclusions about a proposed course of action once it is mentioned. One of the planner's most important functions is to modify this behavior. It is important that he help promote open thinking about alternative courses of action, but this is not possible if people's perspectives about what actions are possible becomes clouded and circumscribed by narrow debate on the implications of a single course of action. Therefore, the planner must try to get participants in the planning process to short-circuit their evaluative debate vis-a-vis a specific alternative, and concentrate first on creating more alternatives. This is a fundamental professional responsibility.

Alternatives can be assessed in any relevant terms. The obvious dimensions are monetary costs and revenues. But planning has extended far beyond such narrow considerations and into such areas as environmental and social impacts. This body of method is only imperfectly developed. Ideally, such analysis would be

based on the planner's ability to predict consequences of actions with certainty. This is far from the situation, except for the most trivial of action/consequence relationships. Ultimately, then, a considerable amount of judgment must be exercised in predicting impacts.

CHOICE

Only in the most simple situations is the choice of a preferred alternative straight-forward. Generally, an alternative that is clearly superior in terms of some consequences will not be superior in terms of all. On what basis, then, is a decision to be made? Several approaches have been advanced, including social cost-benefit and, of course, financial feasibility. Some of these will be discussed in detail later.

EX POST EVALUATION

The ultimate test of the planning process is in how well a chosen course of action achieves its intent. That is, are the consequences of the processes, which were consciously modified, less severe or more desirable than would be the case if the planning action were not undertaken?

This stage of the planning process is crucial but, surprisingly, it has been all too often neglected. Evaluation is now becoming more established as a legitimate planning function.

CHAPTER 2: THE PLANNING PROCESS AND COMMUNICATION PLANNING

The paradigm of the planning process outlined here provides a useful framework for discussing communication planning or what such planning might entail. This discussion will center on those questions which no doubt require considerable debate.

It will be useful to treat communication as a process, and also treat communication as a consequence, as an end in itself.

COMMUNICATION AS A PROCESS

PROBLEM IDENTIFICATION

When communication is viewed as a process it is essentially intermediate in nature—it facilitates the accomplishment of other things. For example, both formal and non-formal communication facilitate the attainment of literacy in a population. This interpretation of communication is analogous to that of transportation as an intermediate process. Transportation facilitates recreation, employment, the delivery of emergency services, and so on.

Viewed in this light, the initial concern of the planner (for example, at the time of problem identification) should not be on communication *per se*, but rather on the consequences of various processes that are identified by his client as problematic, such as health, education, and economic welfare. Only secondarily will an examination of communications processes be required. The planner concerned with a wide variety of problems may rely on the field of communications to provide some insight and, perhaps, solutions to those problems, just as he would seek contributions from other fields such as transportation, education, and public health.

UNDERSTANDING THE SYSTEM

Viewing communication as a process (or set of processes) which contributes both to problems and to their solutions has great significance for planning in general. Just as the knowledge of other social processes, such as migration and behavior in the housing market, provides the planner with sets of concepts which can be used to help alleviate a wide variety of problems, it can be argued that a knowledge of communications processes can assist him in dealing with those problems even more effectively. The planner who is armed with knowledge of only a single class of processes (say economic) will be limited in his perception of how to approach problems. A challenge to the field of communication is to formalize and make accessible an understanding of communication processes to planners in a variety of fields in order that such knowledge can become part of their problem-solving arsenal.

GENERATING ALTERNATIVES

The generation of alternative courses of action in a given problem situation is limited only by the scope of one's understanding of the contributing causes of the problem. As communication processes become increasingly perceived as playing a role in problem alleviation, elements of communication will come to achieve more significance as accepted courses of action. For example, the problem of inefficiency in a large organization might narrowly be approached by the prescription to reorganize its structure. However, it might be demonstrated that organizational efficiency can be improved within the same structure by simply improving communication; this opens up another set of alternative courses of action.

ASSESSING ALTERNATIVES

There are some significant questions that deal with assessing the impacts (or consequences) of alternatives which involve communication processes. What is the set of significant impacts that results from modifying

or improving a communication process? How can these impacts be predicted? Must the planner rely only on "expert" judgment in assessing these impacts, or can predictive models, capable of empirical validation, be developed? Has past experience been systematically documented in such a fashion that it will provide a firm basis for future action? In some fields there is a reasonably strong empirical foundation linking action to consequence. For example, transportation engineers have experienced some success in predicting traffic flow under varying conditions (although failure has been common, too). The task of assessing the impacts of communication alternatives poses an enormous challenge to those in the communication field.

CHOICE

The matter of choosing from among a set of alternatives is not different conceptually when communication processes are included in the planning process.

EX POST EVALUATION

Here another methodological challenge confronts the communication specialist. How is he to confidently, and without bias, be able to determine the role of communication actions in achieving desired ends? This question is no less problematic for other types of actions, of course, but it has already received considerable attention in some fields. It will be possible for the planner to apply general evaluation methodology to communication actions, of course, so the outlook is bright. Evaluation methods will be dealt with in a later section.

COMMUNICATION AS A CONSEQUENCE

There are arguments that communication is an end in itself under certain circumstances. That is, communication or the capacity to communicate has an intrinsic value and is not valued only for what it facilitates. Rosen succinctly addressed the broader question of the distinction between processes and consequences of those processes in his brief piece, "Do We Really Need Ends To Justify the Means?" (1974) Again, there is an analogy with transportation. While transportation is a means toward many ends, it is also enjoyed in its own right, as shown by "cruising," sight-seeing, fast driving, and the like. In a similar fashion, it can be argued that communication by itself can bring to the participant a sense of enjoyment that has very real value to that individual. If the benefit enjoyed by communicating can be derived from no other source, then the communication process is equivalent to an end—an accomplishment worth striving and planning for. This section will attempt to view communication in that way.

PROBLEM IDENTIFICATION

If communication is to be valued in itself, how can the problem of poor, inadequate, or non-existent communication be stated in a given situation so that it becomes operational? What are indicators of such a problem? Is this a latent need with many individuals, and, if so, who is in a position to identify it as a problem?

UNDERSTANDING THE SYSTEM

The system which produces communication is the domain of the communication specialist. Of course, the specification of the system will vary with the setting. The relevant communication systems for a firm, for a small group of individuals, for an educational system, or for a community will consist of very different entities and relationships among those entities. What different communication processes have innate values? In brief, what are the attributes of communication that give it value? Presumably these attributes can be designed into more than one communication process.

GENERATING ALTERNATIVES

Again, this is the domain of the communication specialist. His range of alternatives will be bounded only by his insight into factors which contribute to communication.

ASSESSING ALTERNATIVES

Since the notion of communication valued for its own sake is an elusive one, it is probably the case that the question of our ability to predict the communication outcome of various alternatives is also unsettled. The key question here is, again, what is meant by communication in this sense? If this type of problem can be carefully specified and described by relevant indicators, there is some hope of suggesting and testing methods by which the payoff of alternative actions can be predicted.

CHOICE

Again, as discussed earlier, the matter of choice is not conceptually different in this situation that it is in other decision-making contexts.

EX POST EVALUATION

The issue of ex post evaluation of actions that have been undertaken may not be such a significant issue,

providing that precise indicators of what is meant by communication have been employed in the planning process. Measurement can be made to determine if, in fact, communication has been improved. Of course, such improvement may not be the consequence of the actions taken, but rather of other causes; but the determination of the strength of contribution by the action taken is an issue common to all evaluation research.

CHAPTER 3: ELEMENTS OF URBAN AND REGIONAL PLANNING APPLICABLE TO COMMUNICATION PLANNING

We will now consider some of the methods used in urban and regional planning that may be useful in communication planning. The attempt in this discussion is primarily to make the reader aware of the existence of these methods and of some of their attributes. The methods covered are so wide-ranging and the literature so large that an extensive, annotated bibliography is not possible in this paper. However, an entry into each methodological area will be provided by reference to some basic sources where more complete treatment of the subjects can be found.

PROBLEM IDENTIFICATION

As was suggested in the discussion above, the matter of problem identification has received inadequate formal attention. This section will spell out some of the major perspectives on this crucial step in planning analysis.

OPINION

Informal opinion

Perhaps the most time-honored method of identifying urban and regional planning problems has been the use of "expert" opinion. It has been the case, traditionally, to look to certain individuals, particularly politicians and professional planners, to clarify what was wrong in a community. Of course, every individual also has his opinions, but they frequently do not get acted on unless recognized by the politician or planner. The lack of rigor employed in this method of problem identification has consistently led to a host of difficulties, including the misidentification of problems.

Formal Judgment

Fortunately, in recent years significant progress has been made in processing judgment so that it can, in a sense, be validated. Principal among the methods employed is the Delphi technique. (This method will also be discussed in the section dealing with the assessment of alternatives.)

The Delphi method involves a series of procedures used to systematically gather and process informed judgment so as to come to either: (1) a group judgment on an issue, or (2) a determination that no single group consensus is possible. As applied to problem identification, the Delphi method can be used to elicit problem statements from the participants and justification for the significance of those problems, as shown by problem indicators or other supportive argument. The Delphi method can proceed in an iterative fashion to determine the amount of consensus among the participants about the problem statements.

The Delphi method is widely discussed in the literature. A useful reference is Wedemeyer (1976). Special application relevant to planning is found in Turoff (1970). The principal attributes of the method are as follows: (1) the selection of a group of respondents who, on some basis, are legitimately included in the group; the members of the group do not know who the other members are, and the group is never assembled face-to-face; (2) the preparation and administration of a questionnaire to the respondents; for example, the respondents might be asked what the significant problems are in a given context; (3) the collection of the questionnaires and summarization of the responses; (4) feedback of the initial list of problems; (5) administration of another questionnaire to the respondents, asking them to scale (perhaps by ranking) the list of problems; (6) collection and summarization of the second-round questionnaires; (7) controlled feedback to the respondents, with an identification of extreme responses, a request for justification for extreme responses, and the opportunity for

re-scaling the problem statements. Steps (6) and (7) are repeated (for perhaps as many as three additional rounds) until some stability in responses is achieved.

This approach to problem identification is justified if the respondents are truly sensitive to the problem context in which they are operating and if the staff, in controlling the feedback to the respondents, takes care that the problems are stated in operational form. This procedure might be especially justified in seeking potential problems, in which case respondents might be selected who are especially well-equipped at anticipating future conditions. (A problem-oriented approach to planning need not be reactive; it can also be anticipatory.)

This application of the Delphi technique is not to be confused with its utilization in other contexts. In particular, it has applicability in assessing the impacts of alternative courses of action, that is, in making predictions based on informed judgment rather than predictive models.

In a rapidly changing field such as communications, judgments about future conditions may be the principal source of future problem identification.

"GRASS ROOTS" INPUT

Especially in recent years there has been a growing realization that the values of "experts" are not congruent with the values of members of the general public, and that the identification of problems by these "experts" can result in their missing many significant community problems. The ultimate source of problem identification should be those who are affected by the problems, if there is some vehicle for their expression of those problems.

Recent innovative work has been done by Delbecq and Van de Ven to develop methods for garnering "grass roots" inputs. In their paper, "A Group Process Model for Problem Identification and Program Planning" (1971), they report on a procedure they have developed for quickly and relatively simply eliciting problem statements from any set of individuals. The "Delbecq" process, as we will term it here, is distinctly different from the Delphi method in the following respects: (1) the respondent group meets face-to-face; (2) the "expertness" of the respondent group is a function of its being the ultimate client in the planning process, and not because of any particular basis of substantive knowledge that it may have; (3) the process generally involves about two rounds of question-and-response activity during the problem identification stage; (4) there is an avoidance of revision of the problem statements that are generated, except for fundamental clarification of statements; and (5) there is no striving for consensus, although some ranking is undertaken.

The "Delbecq" process employs some attributes of small group dynamics to generate intense activity and responses during a short period of time. Its worth lies in the fact that it produces a strong sense of participation, regardless of technical training. Its weakness lies in the quality of the statements that are produced. In practice, it is almost impossible to get a non-technically oriented respondent group to grasp the distinction between causes and consequences (between system inputs, processes, and outputs), as discussed earlier in this report. As a result of this limitation, it is necessary to process the raw output produced by the respondents. This requires considerable staff effort, but is worthwhile if there is a commitment to using the ideas that are client-generated in subsequent stages of the planning process. In an era of planning when citizen participation has assumed great significance, this procedure is gaining wider acceptance.

The relevance of the "Delbecq" process to communication planning is a result of its flexibility. Planners can use the process with essentially any group which has some legitimate role in identifying problems. This is much less restrictive than the Delphi method described above, although the nature of the information produced is quite different. The "Delbecq" method may be applied in situations both where communication is considered as an intermediate process and where it is considered an end in itself.

MONITORING AND INDICATORS

In some public service sectors there has been a form of monitoring for many years. Examples include the criminal justice system (arrest rates, rates of incidence of various types of crime), the health system (rates of disease incidence), and the housing sector (rates of new housing starts and of vacancy of existing housing units). In recent years there has been a growing awareness of the need to have a more comprehensive system for monitoring the state of a community's systems--sometimes termed its "quality of life."

Stuart has helped formalize the role of indicators in planning, sorting out some of their alternative uses and interpretations. His definition of urban indicators is quite general:

Urban indicators can be defined quite simply as measures of well-being or the quality of life within urban areas, along social, economic, cultural, environmental, and other related dimensions (1976, p. 144).

In other words, they are empirically derived statistics that provide evidence of the existence of planning problems. Because this function is concerned with communicating a situation to a variety of audiences, it suggests that indicators should be understandable. It is possible to communicate the state of some social condition through the use of a number of simple-to-understand (and simply constructed) indicators; conversely, it is possible to mask the reality of a situation through the use of difficult-to-understand indicators, such as a ratio of differences or a product of several terms. Certain indicators, such as housing vacancy ratios and unemployment rates have become almost universally accepted, in part because of their simplicity.

Stuart distinguishes between three types of indicators. Social indicators "deal with the general community change. They are usually areawide in context, and provide a general index of how well-off the urban area is" (1976, p. 148). An example of a social indicator, using this definition, is the unemployment rate for a region. Impact indicators "are detailed in nature, and can be utilized to assess the effectiveness of public agency plans and programs." An example of an impact indicator is the survival rate of heart attack victims who have been served by a public emergency service. These two types of indicators, with their two levels of specificity, are of great interest to urban and regional planning because they are "output" oriented--they indicate the consequences of public planning and programming.

Stuart's third type of indicator is not of as much significance in this context. He terms this type the performance indicator. It relates the quantity of services delivered, rather than the consequences of those services. While this "input" orientation may be of special significance to the managerial and financial (for example, budgeting) aspects of the overall planning process, it is of secondary concern to the process of program and policy planning.

While the idea of developing a monitoring system for a city or region which would systematically collect a wide variety of indicators is a logical one, it has not achieved widespread implementation. Most agencies which do collect some type of indicator do so for their own internal uses and typically make them public only on a partial and sporadic basis or when such publication serves the interests of the agency. It is likely that in the near future there will be a more conscious development of monitoring systems which serve to inform not only public agencies, but also the public at large of the "state of the community." Suggestions for improvements in this direction are provided by Waller *et al.* (1976).

The relevance of indicators and monitoring systems to communication planning is at least two-fold. First, indicators of how well a population is able to communicate (both in the form of "impact" indicators and "social" indicators, to use Stuart's terms) should be developed, thereby providing a basis for determining how well the communication needs of a community are being met. There are, no doubt, many conceptual difficulties to be overcome in deriving an appropriate set of these indicators, just as there have been in other fields such as recreation. Second, the specification of social and impact indicators of all types of community will help communication planners identify areas in which improved means of communication might alleviate problems facing a community. Of course, such indicators would serve the same function for advocates of other types of action, such as transportation planners and housing planners.

PROJECTIONS

This section is provided here only for completeness. I recognize that the principal methods employed in urban and regional planning are no different from those employed in many other fields and, in fact, are probably familiar to most empiricists.

The most common type of projection involves the extrapolation of a time series of data, such as population. Informal techniques for extrapolating such series involve fitting a line to the data by hand (sometimes called "ruler slapping"); while such a procedure is generally difficult to defend on strictly methodological grounds, it does enable the extrapolator to exercise judgment in interpreting past trends--a factor which may result in more reasonable projections than other methods.

One hallmark of any scientific method is replicability; "ruler slapping" does not meet this test. Other procedures do, however. The first of these is termed "times series analysis." Especially lucid introductions to it are found in Hoel (1966, pp. 278-305) and Croxton and Cowden (1955, pp. 240-259). Time series analysis employs a procedure of deriving moving averages to obtain a long-term trend line (not necessarily linear), and then permits the derivation of ratios which reveal seasonal or other cyclical variations in the original data. This method is useful because it is so flexible; it not only reveals where the data "is going," but also helps to explain the variation in the data about the trend line if the variation has some periodicity. Such periodicity (or seasonal variation) is found in such variables as employment, gasoline consumption, and retail sales. It is hypothesized here that it also exists in communications phenomena such as long-distance telephone traffic and remote computer terminal operations. By understanding both the trend and periodicities, projections can be made that account for such regular variations.

The major class of replicable projection techniques involves statistical regression analysis, which relates a dependent variable to one or more "independent" variables, one of which may be time. (Problems of autocorrelation that are encountered in using this method are beyond the scope of this report, but are acknowledged here.) Methods of simple regression can be found in almost any introductory statistics text, and methods of multiple regression (with more than one independent variable) can be found in more advanced statistics texts, such as Blalock (1972), Draper and Smith (1966), Johnston (1972), and Rao (1973). The essence of the method is that it "fits" a unique line to the data--a line which has a number of attractive statistical properties and is reasonable.

An attractive feature of regression methods is that the line which is fit to the data does not have to be straight. Transformations can be performed on one or more variables (such as replacing them by their logarithms or some exponential function of them), and regressions can be performed on the transformed variables to permit the "best" fitting of non-linear relationships. An excellent treatment of such procedures is provided in Daniel and Wood (1971). Such procedures permit much flexibility in the application of regression techniques.

Another significant method of making projections is to periodically transform or age some base population or other entity. This can be efficiently achieved by use of matrix algebra. This subject is given extensive treatment, as applied to urban and regional planning contexts, by Rogers (1971). One application of this method establishes a population vector, each element of which specifies the number of people in a particular age-sex group (or "cohort"); this vector, then, provides a picture of the age-sex composition of the population at a particular point of time. Of interest is how the population and its composition will change over time. To make this projection, another matrix is constructed which is based on the following information: age-specific fertility rates of females; sex ratios of new-born infants; sex-specific infant mortality rates; and age-sex specific mortality rates. The "survival" matrix which results from this information can be multiplied by the population vector to simulate the growth and decline of the various age-sex-specific cohorts over time; the dynamics of the population are simulated, conditioned by the initial population (vector) and any set of fertility and mortality assumptions that might be made. This procedure has great utility in evaluating the long-run implications of alternative sets of assumptions.

Conceivably such a method could be used in at least two ways in communication planning. First, by "aging" a population of interest and making assumptions about how the communications needs of particular age groups will vary, an indication of communication demand can be derived. Second, and quite different, various types of communication equipment can be considered as the "population" of interest. Aging of the equipment is analogous to aging of a human population, with some "birth" of new equipment over time, some "death" of the old, and transformation of equipment from one state to another (for example, from "functional" to "obsolete") over time. Such an exercise could help to suggest the rate of equipment development and construction that will be required over time.

This section has attempted to suggest a variety of means by which problems can not only be systematically and operationally identified, but also how projections might be made of potential problems.

UNDERSTANDING THE SYSTEM AND GENERATING ALTERNATIVES

COMMUNICATION AS AN ELEMENT OF SYSTEMS

After the problem identification stage, the planning process must concern itself with the specification of the system or systems which contribute to the problem. In any communication planning situation it is essential to try to establish the network of relevant explanatory relationships before going on to prescribe alternative courses of action that might be taken.

Two points need to be made here. First, just as it is not particularly useful to speak of "the" transportation system, as if there were only one, there is little advantage to speaking of "the" communication system. Only in the most general, non-operational sense does that term have any meaning. The system that is relevant to any planning situation will be principally a function of how the problem is identified. For example, again using the transportation analogy, the relevant transportation system for an air pollution problem is different from that for a congestion problem. Different factors must be taken into account for each. Furthermore, the relevant system for a regionwide congestion problem is different from the system for a problem of congestion on a particular small, residential street. Communication planning will be enhanced if attention is paid to specifying in some detail just what communication system is under consideration.

Second, it must be presumed that in most instances communication will be thought of as a set of intermediary processes which contribute to other socially desirable consequences, such as education, health, and so on, and will not be considered as an end in itself. Then it must be recognized, however, that communication

processes comprise only one of many types of processes that contribute to those ends. Other processes, social, political, biological, and so on, are also important in playing parallel contributing roles. Therefore, special attention will have to be given to recognizing communication's relative role in the broader planning context.

The remainder of this section will outline some of the most significant methods which have been used in understanding the processes of urban and regional systems and which might have some transferability to communication planning.

SYSTEM SPECIFICATION

Either formally or informally, planning requires the specification of models of relevant systems. These models are only simplified representations of reality--simplified in the sense that they contain no more detail than is required for their intended use. It is recognized that the rigorous specification of system models is not frequently done prior to the planner's coming to some judgment about alternative courses of action. However, even some non-rigorous system specification is possible in most situations at little cost and effort. Such an exercise can greatly assist in opening up the thinking processes that are being brought to bear on the planning problem.

The essence of the task of system specification is to delineate the significant causes of the problem under consideration. Such a causal structure can be, and is, usefully designated by use of a diagram, such as the following:



This diagram may be interpreted in the following manner: the problem (designated by variable y , which represents the indicator of interest) is a function of two causal variables, x_3 and x_4 ; x_3 is itself a function of two other causal variables, x_1 and x_2 . Of course this diagram represents an unusually simple, and perhaps unrepresentative, case.

The overall planning strategy calls for the identification of those variables which most strongly influence the problem and the specification of ways by which those variables may be affected. This suggests possible courses of action which could reduce the level of the problem.

First, it is necessary to understand just how significant the relationships implied in the diagram are. The relationship must initially be treated as hypotheses and then tested or supported by prior evidence.

The statistical testing of the causal inferences in the diagram is the domain of inferential statistics. There are numerous excellent texts that deal with this general area of analysis. One urban and regional planning text, however, is especially good in its treatment of the subject (see Krueckeberg and Silvers 1974). In particular, their chapter, "Identifying Relationships Among Variables," provides a basic overview which samples the range of statistical tests that can be employed, covering situations characterized by both poor (low-content) information and good (high-content) information. The authors highlight the fact that many planning situations permit the use of only small amounts of data, and data which is measured on nominal or ordinal scales, such as rankings. This highlights the importance of non-parametric statistical procedures in such planning applications as those found in Siegel (1956).

Other useful texts include that by deNeufville and Stafford (1971), which provides a good introduction to both the diagrammatic and mathematical representation of systems and to the empirical tests of the system relationships; and the text by Tufte (1974), which provides an excellent treatment of how one establishes empirically the existence of causal relationships among variables. Another extremely useful reference is the guide by Andrews *et al.* (1974), which leads the user through a "tree" of questions in the search for the appropriate statistical procedure to use in analyzing data. This guide is exhaustive in scope, although it simply makes reference to the appropriate procedures and does not provide details regarding the mechanics of their use.

The systems approach that is being advocated here is one that attempts to isolate important, yet

relatively simple, relationships among key causal variables in a system. In those social systems with which planning is concerned, it is commonly the case that the explanatory power of these relationships is far from "ideal" in its predictive ability. It is simply not possible to isolate all the factors which cause some problem and to measure the contribution of each factor. The diagram provided above belies the complexity that is common in social systems, and does not suggest some sources of complexity such as feedback and simultaneous determination of interrelated variables. Many attempts have been made at constructing elaborate models of complex systems and incorporating a great number of variables and relationships. This subject will be discussed in the following section. Efforts at "large-scale" models have met with only mixed success. In light of that experience, a more modest approach is advocated here--one based on isolating key variables and relationships which are pertinent to a particular problem, and minimizing the scope and complexity of the system under consideration to the extent possible. The principal tools required in this type of endeavor are relatively straight-forward statistical procedures and are not elaborate model-building and computer-simulation techniques.

ANALOGY TO TRANSPORTATION AND OTHER NETWORK SYSTEMS

Some types of communication involve the flow of discrete messages between points over a route or routes connecting those points. Analogous to such communication flows are flows of other types, including flows of people and goods (transportation), electricity, and tasks (in which case a project is viewed as an ordered sequence of individual tasks).

There is a considerable body of methodology which deals with constructs such as these, commonly termed "network analysis." This body of method has developed a useful way of analyzing such phenomena in general and in many specific situations. Special attention will be given here to transportation networks.

Network Analysis

There are numerous rigorous texts in many fields which examine network analysis. One which is appropriate for our purposes here is that by Rogers (1971). Most general operations research texts, such as those by Hillier and Lieberman (1967) and Wagner (1969), devote major sections to this methodological area.

One problem common to many types of network analysis is that of selecting among alternate routes in a network in order to optimize something. Each branch in a network (typically) has some fixed capacity, for example, the number of vehicles per hour which can pass on a given section of road. All of the texts cited above discuss the "transportation problem," which is concerned with minimizing costs while transporting required quantities of goods between diverse points, over a capacitated network. This task is analogous to the communication problem of minimizing the cost of processing messages over a capacitated communication network.

A related problem is that of maximizing the volume of traffic through a capacitated network, whether it be a transportation or communication network. The solution procedure which can be employed for these problems is linear programming (although some specialized optimization problems such as the transportation problem have properties that permit independently derived solution procedures). This method receives fuller treatment later in this part.

To the extent that a communication system can be formally specified in mathematical terms and to the extent that the mathematical relations can be assumed to take the appropriate forms, very powerful tools such as linear programming can be employed to give particularly inexpensive, yet insightful, results. This is not an argument for the wholesale application of such procedures. Optimization techniques have frequently been oversold without due recognition of their limitations. Yet they should not be overlooked in situations which permit their application.

Other applicants of network analysis which should be noted include the assignment of households to housing stock, outlined in Rogers (1971, p. 357) and the critical path method (CPM), which deals with the problem of identifying those task components of a project which are "critical" in the respect that any delay in their completion will delay completion of the total project. CPM analysis is, perhaps, more appropriately a subject of the administrative sciences than of planning, but is nonetheless significant in the implementation phase of a broad variety of contexts, including communication planning.

There is no doubt that network analysis will become an increasingly significant methodological area for communication planners because of the nature of the systems with which they work.

Queueing Models

Communication in its broadest sense involves a number of social, biological, and technological processes. Communication planning must recognize how these processes function in order to work toward desired ends. This and the following section will suggest how two types of phenomena have received methodological treatment at the micro scale in order to indicate that such application to the field of communication is possible.

The first type of phenomenon is queueing--typically, the arrival of people in a line with their subsequent servicing. Examples are all too familiar to the commuter: autos arriving at a stop signal or toll booth. "Congestion" is a word that can be associated with queueing processes. There is an analogy with more general communication processes: messages may form a queue prior to their transmission. The methodologist confronts the problem of determining how the queue should be served, given the fact that serving it is costly but that poor service of the queue is also undesirable (that is, it has some cost associated with it).

Queueing processes are treated in many operations research texts, including Hillier and Lieberman (1967) and Wagner (1969). The essential elements of these processes are the following: there is an input source, or "calling population," members of which occasionally require service; and there is a queueing system which consists of a queue and a service mechanism. One of the features of queueing models is that "customers" are generated not by a regular, predictable process (for example, one customer every hour), but rather by some random process. This results in occasional periods of peak demand on the system (long queues) and occasional periods with slack demand (short queues or none at all). The service mechanism will incorporate a service discipline (typically first-come-first-served) and a specified number and arrangement of services (for example, parallel channels). Queueing processes also may have service times of random duration.

This type of analysis permits the prediction of queue lengths given varying conditions regarding service time and number of services and assumptions regarding the probability distributions of customer arrival times and service times. (Under certain circumstances analytic solutions can be derived, while some sets of assumptions may not permit such straightforward solution, but rather may require computer simulation of the process.)

Queueing processes are innate to time-sharing computer systems and to many other communication processes, including those where centralized message sending and receiving facilities are employed. While the level of analysis implied in queueing systems may appear overly detailed for many purposes, it should be recognized by the general communication planner that this type of analysis does exist, and that it already is employed by certain communication technicians.

Modal Split Models

In an age when increasing attention is being given to shifts in usage from one form of transportation to another and the substitution of telecommunication for transportation, a class of models employed in transportation planning should be of special concern. That is the class of modal split models. These models are concerned with predicting the relative amounts of travel (typically peak hour demand) that take place using different types (modes) of transportation, such as the private automobile, public buses, and carpools. In the field of transportation this is a matter of great importance. Some of the lessons of that field may have great significance for communication planning.

First, let us put modal split models in context. A classic approach to traffic forecasting, frequently done on the metropolitan scale, involves a string of predictions. After dividing the region into a set of geographic zones, the first step generates trips for each zone on the basis of its population and land use characteristics. The second step distributes the trips between zones; that is, trips T_{ij} from zone i to zone j are predicted. Modal split models then predict how the trips will be distributed among the various modes of travel between the various sub-areas. And finally, traffic assignment models assign trips to particular routes in the transportation network. (Modal split projections are usually accomplished along with trip generation or trip distribution projections.)

An especially good introduction to modal split analysis is provided by Hutchinson (1974). Some of the findings of that text are summarized here. (The interested reader is referred to Chapter 3 of Hutchinson for additional details and references.) One's expectations of modal split analysis must be tempered in approaching this methodological area, however. While considerable work has been accomplished, much remains to be done. The analyst's predictive ability has not been great. Furthermore, as the behavior of the traveling public changes in response to the stimuli of new conditions, such as significantly higher fuel prices, much rethinking of modal split analysis will be undertaken. This area of analysis is currently of great interest to transportation planners.

Modal split analysis has undergone much development in recent years. Earlier models were primarily based on general characteristics of the various travel zones (for example, relating transit usage to an index of zone accessibility to major employment areas); more recent models have tended to test and incorporate hypotheses about the behavioral response of individuals to different environments.

Typical of the earlier models were those developed for Southeastern Wisconsin and for Toronto, as reported by Hutchinson. In the Southeastern Wisconsin model, surfaces were estimated that related the public transport proportion of a particular zone's trips of a given type, (that is, home-based work trips) to some

attributes of that zone (for example, the average number of cars per household in the zone). The Toronto effort was more explicit in its consideration of variables that were hypothesized to explain the proportion of transit usage. It identified four principal factors affecting the modal split: relative travel time (public transit vs. car); out-of-pocket costs of these two modes; relative travel service of these modes; and economic status of the tripmaker. This class of models, with its zonal basis of data aggregation, is not sensitive to intra-zonal variations and does not incorporate more recent thinking on the behavioral basis of modal choice phenomena.

More recent models have paid attention to individual behavior rather than to aggregated behavior. One approach has been to identify generalized utility functions which specify the relative importance assigned to various factors, such as various money costs and time costs, by tripmakers in implicitly making their modal choices.

More recent work has concentrated on specifying the probability density functions that relate binary modal choice to some utility measures. These approaches employ a variety of methodological techniques, including multiple discriminant analysis (a multivariate statistical technique used to sort out significant explanatory variables), probit analysis, and logit analysis. These are reported, respectively, by Quarmby (1967); Warner (1962), Lisco (1967), and Lave (1969); Stopher (1969).

Recent developments in modal split analysis will no doubt receive considerable attention from communication researchers who will be concerned with the behavior of users in selecting among competing and rapidly changing modes of communication.

Large-Scale Models

While models of micro social processes, such as the models of modal choice discussed above, have received the attention of some urban planning methodologists, others have concentrated on more comprehensive models which incorporate a number of processes. These modeling efforts have generally centered around land use allocation processes and have included transportation, housing market, and other processes. Lee (1973) has referred to this class of models as "large-scale models." They represent a major effort of urban theorists and methodologists to improve their predictive ability with respect to complex urban structures--structures which involve multiple decision making units and interacting sub-systems.

The optimism which spawned the development of such models was largely the consequence of computers' increased capacity to manage large amounts of data, which resulted not only in an increased ability to derive complex relationships empirically among many variables, but also to construct models which could "unfold" over time. That is, the processes inherent in the models could be made to move through a sequence of simulated time periods. Frequently these models have been termed "simulation" models, although many methodologists reserve that term for models which incorporate random (stochastic) processes in their structures.

At the risk of over-simplifying the major developments in this area of analysis, large-scale models will be grouped into two types for discussion here. The first type is the class of spatially disaggregated models; the second class is of non-spatial models which, nevertheless, maintain their "large-scaleness" because of the complexity of relationships among their components.

The spatially disaggregated models have had multiple intended uses, but principal among them has been transportation forecasting. A typical argument for such a model is this: we can first project an urban area's population growth over a period of years; then we can project basic sector growth (for example, industries that principally are region- or export-serving); we can assign basic industrial uses to available land in the metropolitan region and then residential and commercial uses to land available and suitable for them. Up to this point, we have a land-use allocation model. Of course, we have not specified the manner in which the allocations are made; a variety of rules for those assignments is possible. With the development of large-capacity computer systems it became possible to construct land-use models of this type with fairly small geographic zones and to account for thousands of allocations to these zones in a detailed, incremental manner until some acceptable equilibrium end-state was achieved.

The basic reasoning used in this class of land-use models is set out in Lowry's A Model of Metropolis (1964). Lowry's relatively brief statement outlining the land-use allocation algorithm has been the basis of much of the subsequent activity in the field.

Once the land use allocations are projected in such a fashion and with assumptions regarding future transportation system improvements, projections of trip generation, modal split, and traffic assignment can be made. This chain of projections can then be used in evaluating alternative transportation strategies.

A review of some of these modeling efforts is found in Hemmens (1970), in Goldner (1971), and in

Kilbridge et al., (1970). Perhaps the most strenuous critique of such efforts was made by Lee (1973). Lee questions the utility of such efforts on both theoretical and methodological grounds. First, according to Lee, such models are inefficient because of their "hypercomprehensiveness." That is, they try to represent too much of what is actually taking place. Certainly everything is related to everything else, but trying to model so many relationships shows our lack of theoretical understanding of them and ultimately leads to cluttered models. Second, such models exhibit "grossness." While the models try to take in the whole city, they do not provide sufficient detail to be useful to policy makers on most issues. Third, the models are "hungry" for data. Data collection and processing is very expensive, and the results of the models have not justified the expense. Fourth, such models are overly "complicated." They involve a multitude of estimated relationships, each of which has some error of estimate associated with it. Simulation involving chains of such relationships results in the compounding of errors, with the consequence that the overall projection must be suspect. That is, the macro consequences of the urban processes may be wrongly predicted because they are derived from a string of hundreds of thousands of projections of micro-level processes, each of which necessarily has some statistical error associated with it. (Furthermore, rounding errors during the process of computation can also compound and add to the total error, a quality of such models which Lee attributes to "mechanicalness.")

The second class of large-scale models is characterized by complexity without spatial disaggregation. The best known of these efforts is Forrester's Urban Dynamics (1968). That effort was the result of applying the simulation methods that Forrester had previously applied to Industrial Dynamics (1961); subsequent application resulted in World Dynamics (1971). Forrester's urban model is intended to demonstrate some of the intermediate and long-run consequences of urban processes and policies. It does this in a somewhat abstract manner, using reasonable, but not empirically derived, relationships that might be found in a metropolitan area. The emphasis of the model is on system feedback effects and the implications of resource constraints. But because of its restrictive empirical basis it is unclear just what the utility of the model is to any particular decision making situation.

Lee (1973) has suggested that more modest approaches toward modeling urban and regional processes would be more fruitful than the large-scale efforts described above. This author concurs. First, the test of a model is its usefulness and not whether it simulates reality in its own internal processes. All too frequently models lose sight of the particular questions they originally are designed to answer. The larger they are the more they become cumbersome, costly, and tardy in producing results. Second, it is too easy to hide ignorance within large-scale models; they are too complex to understand. Models should have a logical basis that is open to outside inspection. Some people term this quality "transparency." Assumptions should be made explicit; "black boxes" should be avoided. Unfortunately, complex models can become tools of those who do understand their structure and who can manipulate them to produce desired results.

The prospect is that there will be a growing interest in the urban and regional planning field in the development of sophisticated modeling capabilities. The experience of urban and regional modeling has ranged from very discrete, "small-scale" models, with very limited purposes, to extremely complex, "large scale" models, which have attempted to serve many purposes. The experiment with large-scale models has been a natural consequence of improvements in data-handling capabilities, and it has, in general, been a worthwhile experiment. There is now some recognition, however, that the large-scale results have fallen short of expectations. Of course, there are still many advocates of large-scale modeling, and experimenting in this direction will continue. But a realistic progress report must conclude that more directed, modest modeling efforts hold greater potential for payoff at this time. The implications for modeling complex communication systems, particularly those involving poorly identified human behavior are clear: complex, large-scale models of such systems are undertaken only at great expense and risk of failure.

Gaming

The modeling techniques discussed above have generally relied on computer simulation of the processes involved. In recent years, another area of methodological development has been gaming, which permits people to play roles subject to rules, and thus to act out social processes. Of course, the idea is nothing new; the game called "Monopoly" has existed for many years. In a sense, many of the newer games are simply elaborated versions of "Monopoly."

The best known of the first-generation urban games, developed by Feldt (1972), is CLUG--the Community Land Use Game. CLUG employs a square board on which is imposed a rectangular land-use grid. The players make decisions through a sequence of rounds, buying and developing land, and, on a community basis, providing it with services. The rules serve to reward players who make "good" decisions from an economic perspective, and to penalize those who do not. The game permits the players to better understand how economic forces in the community help to shape it, and also demonstrates how cooperation (some might call it "planning") can have payoffs to the whole community.

Various refinements of the basic CLUG model have been developed. However, many of these refinements

have lost sight of one of its important attributes--the ability of the player to comprehend what was occurring in the system he was helping to shape. This lack of comprehensibility became all too apparent in models such as CITY I and METRO. Those and other games are briefly covered in Inbar and Stoll (1972). These later games, because of their complexity, necessitated the use of computers for accounting for the many transactions and consequences of the actions taken by the players and teams. These later versions were successful in demonstrating that cities are complex organisms--but that was known before their development. They became somewhat frustrating to play (although remaining somewhat intriguing) because the player was so beset with constraints and rules that he had little time to comprehend the larger lessons confronting him. He could not see the forest for the trees, although, if he were interested, he could come to a better understanding of the particular role he was playing, such as a city councilman or editor of the city newspaper.

The lesson of gaming seems to be that it can provide a kind of learning experience, through personal involvement, that cannot be found in other situations. However, as games become more complex, in a striving for reality, they lose some of their impact.

It is unclear to this author whether there are many situations confronting the communication planner which call for a gaming approach to learning. In the urban planning context, the usefulness has been primarily with respect to clarifying why processes work in the direction they do; this is descriptive modeling. Failure has been more prevalent when games have been constructed for the purposes of making predictions of larger social processes. This experience has been roughly parallel to that of large-scale models treated in the preceding section.

This section has dealt with a number of models used in urban and regional planning--suggesting methods which may have some transferability to communication planning. The experience of these modeling efforts has not been altogether fruitful. But their consideration should prove useful before methodologists embark on parallel courses of action in other fields of interest, such as communication planning.

ASSESSING ALTERNATIVES

One of the key functions of planning is to attempt to foresee the consequences of action. Given the complexity of the social processes with which he is dealing, it is no wonder that the urban and regional planner has achieved only mixed results in his predictions. The list of consequences or impacts that should ideally be anticipated and hence predicted is without limit, and constantly growing. It is only in relatively recent times, for example, that interest has been sufficient to warrant making predictions of certain environmental impacts. Social impact analysis is still in quite a crude state of development.

This section will specify some of the more significant developments in the field of impact assessment. It should become apparent that some of these forms of impact assessment will have application to communication planning, although some, particularly those developed for predicting the effects of large-scale physical improvements such as highways may have less relevance.

ENVIRONMENTAL IMPACTS

There are two ways in which the term "environmental impact" is used. First, there is the narrower sense, in which case "environment" is taken to mean the natural environment. Much recent development has been accomplished in this field. A convenient means of organizing such impacts is found in Keyes (1976), in which he organizes the impacts into the following classes: (1) air quality; (2) water quality and quantity; (3) wildlife and vegetation; (4) noise; (5) natural disasters other than floods; and (6) scarce resource preemption. Keyes provides an introductory treatment of many of the natural processes which must be understood in order to make useful predictions. A bibliography of resources that may be used in making such predictions is found in Burchell and Listokin (1975). There is little utility in elaborating on those methods here because of their diversity and weak association between those processes and communication processes.

Second, there is the broader sense in which the term "environmental impact" is used: that is, the environmental impact statement (EIS) as required by law, regulation, or executive order in many jurisdictions. The requirement for an EIS in conjunction with a proposed action is generally nothing more than a requirement that alternatives be evaluated prior to taking action. Environmental impact statements usually are broader in scope than the natural environment; regulations call for consideration of social and economic consequences of the action as well, and require that due consideration be given to alternatives to the proposed course of action. EI regulations, then, are really requirements that some minimum level of responsible planning be undertaken, and are not limited to what is implied in the title "environmental impact statement." The broader concept of the EIS is treated in a variety of sources, including Burchell and Listokin (1975), Schaenman and Muller (1974), and Dickert and Domeny (1974). Some of these considerations will be treated in the sections to follow.

COST-BENEFIT ANALYSIS

The methodological area of cost-benefit analysis has received considerable attention by urban planners for many years. Yet a great deal of misconception of the method continues, as is frequently seen in applied studies. A distinction should be made between two related types of analysis: fiscal impact analysis and social cost-benefit analysis. Fiscal impact analysis is concerned with the actual cash flow of money--dollars out and dollars in. It is, quite naturally, of considerable interest to government, particularly local governments, which do not have the perpetual borrowing capacity enjoyed by the federal government. (Many units of government are required to balance their budgets.) An approach to estimating the fiscal impacts of land development is provided in Schaeffer and Muller (1974).

Social cost-benefit analysis (to use the complete nomenclature assigned it in much of the economics literature) does not limit itself to the consideration of actual flows of money. Rather, it is concerned with the values assigned by affected people to advantages and disadvantages that follow from some action. These values are (ideally) measured in monetary terms, and hence are labeled benefits and costs, respectively. The method makes a distinction between the willingness to pay for consumption of some good or service (such as admission to a park) and the amount that is actually charged. Using the example of the park, the argument is that society benefits from the provision of the park regardless of whether or not admission is charged; the indication of how much society benefits is how much potential users are willing to pay to gain admission. (The actual amount of admission is of primary importance to fiscal impact analysis.)

A distinction is also made between the actual monetary cost of undertaking an action and what is termed its "opportunity cost"; the opportunity cost is the utility which is foregone by devoting resources to the particular action, and is also (ideally) expressed in money terms. For example, in constructing a park, land must be restricted from other potential uses. The value of the land in an alternative use is its opportunity cost in park use. Other scarce resources, including cash which would have to be expended over time by government, also have opportunity costs associated with them.

Cost-benefit analysis in the pure sense, then, is a consideration of these and other issues which are much more subtle than the actual flow of dollars. There are numerous treatments of cost-benefit analysis that deserve careful examination. A few of them are Rothenberg (1975) and Mishan (1976), the latter of which is very comprehensive. The many issues involved, in addition to those mentioned above, are beyond the scope of this report, although the topic will reappear in the section below concerned with choice.

SOCIAL IMPACT ANALYSIS

Traditionally, urban and regional planning has emphasized three areas of analysis--population, economics, and land use. Plans were intended to set out a blueprint for future growth of the community while assuring some reasonable balance between population and economic growth and the demand for land; major emphasis was placed on the prior identification of physical improvements that would be required to help assure this balance, such as public rights-of-way, parks, and schools. These plans had a physical basis. Their principal recognition of people was with respect to their roles as employees, the consumers of services (education, recreation, and the like), and users of residential land.

Unfortunately, the experience of many communities in effectuating their physical plans has been to ignore other dimensions of their populations. The dominant lesson has resulted from highway construction in urban areas, which, primarily during the 1950s and early 1960s, resulted in the fragmentation of viable--if frequently low-income--neighborhoods and the disruption of many communities through haphazard relocation of displaced households. These and other unintended and unanticipated consequences of public programs resulted in a greater sensitivity for the need to anticipate the impacts of actions on people, in more than just an economic sense. This area of interest is termed "social impact analysis."

The analyst's ability to predict the social impacts of actions is woefully poor. In part this is due to the lack of specificity regarding just what qualifies as a social impact. At one level such impacts can be described in terms of states-of-change of personal attributes or of the environment. For example, a program might result in a higher level of education for a group of people; or in newer housing for them. But that is not the level of specificity that is generally of interest. Of more interest is the perception by the affected individual of how his level of welfare is changed by the action: what consequences do the higher level of education or the newer housing really have? What are the individual's and the community's attitudes likely to be toward them?

The methodological problems involved in answering questions of this type are enormous. It is much easier to predict future levels of economic activity with some degree of certainty than it is to predict people's attitudes about their own welfare. The state of development of the field of social impact assessment is, as a consequence, quite primitive. Social impacts tend to be predicted using the judgment of informed professionals. Some structure for this process has been suggested for application to assessing the impacts of highway facility improvements

in a report for the U. S. Department of Transportation by Skidmore, Owings, and Merrill (1975). That report summarizes some of the social and personal impacts that have been observed in the past, suggesting variables of interest that should be observed in the subject population (for example, length and type of tenure of the population in the neighborhood being affected). The process that is outlined calls for obtaining, organizing, and displaying information and then trying to draw conclusions from it. This is undertaken for each transportation alternative considered.

Surveys of those affected by an action have also been suggested as one means of determining potential impacts. However, care must be exercised in attempting this because of the inherent difficulty in obtaining reasonable, accurate assessments of behavioral response to future conditions with which the subjects have no prior familiarity.

There is some opportunity for employing structured techniques such as the Delphi method in assessing social impacts, although to this author's knowledge there has been little experience in this direction.

Communication planners--by the very nature of the processes with which they are dealing--must consider a wide variety of impacts of their proposed actions, including social impacts at various levels of specificity. Contributions to this methodological area are needed.

THE STATE OF IMPACT ASSESSMENT

The list of impacts that should be considered in assessing any proposed action will be a function of the particular circumstances of the situation at hand. The analyst's ability to predict impacts is severely limited at present. This is a consequence of limits in our theoretical understanding of the processes involved and empirical difficulties attending efforts to test hypothesized relationships between action and consequence.

The preceding sections only hint at some of the major classes of impacts that might be considered during the planning process. Any number of others could be suggested. Obviously one type of impact that should be considered is given by the original problem statement. If a program is being undertaken to improve a certain type of health condition, for example, then the impact on that condition should be assessed. The impact assessment stage of the planning process has broader significance, however. An action has many consequences, not only those originally intended; consideration should be given to all those consequences that are considered important.

Impact assessment will continue to embrace a mixture of judgment and formal predictive modeling. Many of the most interesting--and perhaps most significant--impacts, such as those dealing with individual satisfaction, cannot be readily predicted. Nevertheless, it may be possible to provide greater structure to the use of judgmental predictions in order to reduce the chance of bias in the analysis.

A final point must be stressed. The impacts of most utility in planning are those which relate consequences to which people can assign value. For instance, it is only of indirect significance that an action might result in increased erosion on a piece of land. But if the sequence of events is taken farther to indicate how people are affected emotionally, socially, economically, or in other ways (for example, people will not be able to fish in some body of water, or others will lose valuable cropland) then there is a firmer basis for decision making. Most people cannot relate to intermediate consequences. Impacts should be discussed by considering ultimate outputs of the processes.

If decision making is to be promoted as an open process, thus recognizing the wishes of broad constituencies, broad-scaled impact analyses must be undertaken. The autocrat need not justify his decisions on the basis of anticipated consequences.

CHOICE

Urban and regional planning decisions are made in a political, and not a technical, environment. A continuing source of frustration to some planning methodologists is the fact that so-called "rational" decision rules are frequently by-passed in making the ultimate decision regarding a course of action, in spite of the fact that much elaborate technology is employed in other phases of planning analysis.

Here we will look at a few different classes of methodology designed to assist in the choice among alternatives. All may have applicability to communication planning.

FINANCIAL CRITERIA

In the preceding section dealing with impact analysis, consideration was given to assessing both the

fiscal impacts and the (social) costs and benefits of proposed actions. Those types of analysis have associated with them criteria for selecting among competing alternatives.

Fiscal Criteria

The fiscal approach is presented in deNeufville and Stafford (1971) and numerous other engineering texts. Basically, it calls for summarizing flows of revenues and expenditures over time in such a way that comparison among projects can be made. One method is to determine the internal rate of return of each project (the discount rate which equates the project's stream of expenditures with its stream of revenues), and select projects on this basis, selecting first those projects with higher rates of return (perhaps subject to the condition that those rates be greater than the cost of capital).

However, it has been demonstrated by Lorie and Savage (1965) and others that this decision criterion is not always optimal. This is because short-duration projects with high yields may not have as much payoff as longer-duration projects with lower rates of return.

This suggests another criterion, net present value. For any future revenue or expenditure its present value can be evaluated, given an appropriate discount rate. Time streams of revenues and expenditures can be succinctly summarized in terms of the present value of net revenues. The net present value criterion calls for the selection of that project with the highest present value of net benefits.

Cost-benefit Criteria

An excellent source for a thorough treatment of cost-benefit criteria can be found in Mishan (1976). The first criterion, and one of the most commonly cited, involves the benefit/cost ratio. This criterion calls for a ranking of projects by their B/C ratios, utilizing the (discounted) present values of benefits and costs, and the selection of those with the most favorable ratios. There are some errors in using this criterion in the simple form stated above, however, as discussed by Mishan. It is possible to reconcile the B/C criterion with other criteria, however, as Mishan discusses at length.

The second criterion is strictly analogous to the net present value criterion employed in fiscal analysis. The task here is to assess net benefits rather than net revenues. The issue is complicated by the need to determine a discount rate that (ideally) has broader significance than the cost of capital employed in fiscal analysis; here a more elusive "social rate of time preference" is sought, or at least some more comprehensive measure of the opportunity cost of capital, and not just what the interest rate is that confronts government borrowers.

The third criterion, which is consistent with the net present value criterion, is the true rate of return criterion. It overcomes the difficulties encountered in applying the internal rate of return criterion alluded to earlier. Full consideration of these issues is beyond the scope of this paper; they are mentioned here only to suggest the nature of theoretical and methodological developments in the field.

Fiscal and cost-benefit criteria are precise. But their usefulness is limited because so few programs have consequences that are primarily measurable in monetary terms. The optimism of several years ago suggesting cost-benefit analysis as the general evaluative and choice method for complex programs has waned. While it does have great utility in situations where its assumptions are acceptable, it must be recognized as only one of many tools in the planner's methodological toolbox. Fiscal analysis is even more restrictive, with its consideration of cash flows only; of course to many decision makers this is of paramount consideration, but it does not get to the matter of why governmental programs are generally undertaken. Methods are needed which consider more than monetary variables.

OPTIMIZATION TECHNIQUES

Seeking the optimal solution to a problem has been a concern of the mathematical sciences for centuries and has blossomed in recent decades. A broad field of applied mathematics, frequently termed "operations research," has developed. A major, ongoing goal of operations research is to develop tools for providing solutions to complex problems. Any basic operations research text such as Hillier and Lieberman (1967) or Wagner (1969) will devote major sections to optimization techniques. To some extent, they are treated in urban and regional planning methodology texts such as Krueckeberg and Silvers (1974).

The operations research method of most interest is linear programming (LP) and its variants. The classic problem which can be addressed by LP is to determine that allocation of limited resources among competing demands which optimize some objective, all the while taking into account the relative costs and payoffs of various decisions and the relationships among the many variables.

Linear programming is noteworthy because, of all the optimization techniques developed in the field of

operations research, it has proven to be probably the most flexible and frequently used. Other optimization methods, which will not be treated here, include dynamic programming and integer programming (a variant of linear programming); these and related topics are also covered in Hillier and Lieberman (1967), Wagner (1969), and other basic operations research texts. There are numerous texts which specifically deal with linear programming, including those by Dantzig, the "father" of the method (1963) and Laidlaw (1972), the latter of which is more specifically related to urban planning.

The key features of linear programming are the manner in which problems are formulated, the method of solution, and the type of information which is produced with the solution. Linear programming problems are stated in terms of an objective function and constraints, all of which are mathematically represented by first-order linear functions of a set of variables. The objective function specifies whether the objective is to maximize or minimize something (such as profits or costs, respectively). The constraint set consists of a number of equations and inequalities which reflect the conditions which constrain the possible solutions to the problem, such as material and budget limitations, minimum required performance, and so on. The LP procedure seeks the optimal solution in a computationally efficient manner; computer algorithms permit the optimal solution of problems involving literally hundreds of constraints and variables. Of particular importance is the type of output provided with the solution. In the typical resource allocation problem, LP not only specifies the mix of actions which will optimize the objective but will also indicate the marginal worth of the resources that are being employed. For example, if one of the limited resources is skilled manpower, the solution will indicate how worthwhile it would be in terms of the objective of the problem to obtain additional skilled manpower. Or, in the case of a transportation problem, information would be generated to indicate the utility of increasing the capacity of a particular transportation link. This "sensitivity analysis" of the relative worth of resources is often as important as the identification of the optimal solution itself. Such sensitivity analysis is an important component of all optimization techniques, but is particularly easy to derive from linear programming.

While linear programming is a powerful technique, it has obvious limitations. It requires that all information pertinent to the problem be quantified and, even more restrictive, that it be in terms of linear relationships. (This is a slight overstatement; some non-linear relationships may be capable of treatment by LP.)

Other techniques such as dynamic programming provide more flexibility in the assumptions that need to be made about the system under consideration, such as permitting non-linearities; but they, too, have stringent limitations.

It is easily argued that a weakness of such optimizing techniques is that they require that values (pay-offs) be made precise, while, in reality, decision makers are either unwilling or unable to do so, particularly for the types of problems confronting urban and regional planners. This may no doubt be true, and it raises the question of how far rigor can be pushed in such situations. One advantageous attribute of many methods of operations research is that they permit the testing of how alternative relative values imply alternative optimal decisions; this is a form of sensitivity analysis which can result in improved decision making without prior, precise specification of values.

By now, however, it is recognized that there is little hope for optimizing complex social systems. They are too complex to grasp. Rather, it is more reasonable to seek improvements. This is not surrender, but rather recognition of the analyst's (and others') innate capabilities.

MULTI-DIMENSIONAL COMPARISON

For many purposes it is impossible to evaluate the desirability of very dissimilar consequences of different actions. It is not possible to trade off health and income, for example, on purely technical grounds. This suggests that our choice processes should consider the multiple consequences of proposed courses of action without unduly combining measures of those consequences. Of course, if it is convenient to combine some effects, for example, by being able to assign monetary values to them, then it is permissible to do so. In other instances, however, the identity of the different types of consequences should be preserved.

Hill (1968) has formalized some of the issues inherent in complex comparisons in his work on a goals-achievement matrix for plan evaluation. This work provides a useful bridge between cost-benefit analysis and the need expressed above for evaluative methods which are not so tidy. Hill argues for maintaining the identity of the various objectives of a program--and not forcing their combination--but perhaps pushes too hard the notion of assigning weights to the various objectives. Again, it may simply be impossible to get decision makers to be as explicit in assigning values to outcomes as the method suggests is appropriate.

It is likely the case that the most useful general method for providing information to decision makers in complex choice environments is to make as explicit as possible the many consequences that are expected to

result from each alternative under consideration. The technical process of simplifying this information into a smaller number of indices may mask important distinctions among the alternatives, if such a process is at all possible. The methodologist's principal role is to make the expected consequences understandable and not to assign them values.

EX POST EVALUATION

The ultimate test of the planning process is to examine the results and compare them with prior expectations. Great strides have been taken during the past two decades in the field of general evaluation methodology. Some basic references include Suchman (1967), Guttentag and Struening (1975), Rossi and Williams (1972), and Bogdan and Taylor (1975). Those references provide the basic reasoning behind evaluation research and examine the methodological issues of evaluative research design. This field is bound to grow tremendously as demands grow in many quarters for evaluation of all types of programs.

Such demands are being placed increasingly on urban and regional planners, to the extent that evaluation is becoming a sub-field of specialization. Increased interest may be seen in the publication of a growing amount of reference material for the practicing--and not just the academic--planner. Some examples are Hatry, Winnie and Fisk's Practical Program Evaluation for State and Local Government Officials (1973) and another Urban Institute report, Measuring the Effectiveness of Basic Municipal Services (1974).

The fundamental problem of evaluation is to compare what is with what would have been if a particular action had not been undertaken. In simple, stable situations this is not a particularly serious problem, but in complex situations it is. How are the influences of the program that was enacted to be distinguished from those of other programs? How do we know that the problem wouldn't have gone away without our doing anything? Isolating these and other effects is the methodological challenge that is addressed in the references cited above. Evaluation requires a knowledge of many areas of methodology, but particularly descriptive and inferential statistics, and, for many applications, survey research methods.

Mention should be made of an interesting type of policy evaluation that has been receiving increasing interest. This is the evaluation of implicit policy that is revealed by examination of a record of decision making. A particularly interesting example to urban and regional planners is found in Lowry's Control and Consequence: The Implementation of Hawaii's Land Use Law. By using the discriminant analysis, Lowry was able to reveal the implicit criteria employed by Hawaii's Land Use Commission over a period of many years.

Beyond this overview there is little to be gained here by elaborating on this collection of methods, because the methodological requirements vary considerably from situation to situation. Suffice it to say that a considerable amount of methodology originally developed for other purposes is employed in evaluation research, including very sophisticated predictive modeling, survey research, statistical analysis, and program monitoring, referred to earlier in this paper. Monitoring really brings us full circle: it can be employed to continually assess the state of program performance; and when performance falls below some acceptable level it suggests the existence of a problem. We are now back to the point of problem identification, where our planning process began.

A SUMMING UP

This report has attempted to pull together a wide variety of methodological material which is more and more a major part of the urban and regional planner's toolkit. Obviously, many other developments could have been included, and many more references cited. It is hoped that this experience will be useful to those embarking on parallel activities in communication planning.

It is important to recognize that the planner's forte is not in particular analytic skills, however. It is in the way he perceives problems, relates them to his client, and borrows from the range of methods available while operating within the constraints facing him that either enhances decision making processes or provides an exercise in frustration and missed opportunities. The most important method the planner can employ is one which can sort out an ambiguous situation and make it understandable. Experience suggests that the planning paradigm provided in this report can provide such a sorting method in a broad variety of situations. Communication planning methodologists would do well to concentrate first on that overall structure before getting imbedded in finer, but ultimately less important, distinctions.

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PART 5

Educational Planning: Lessons for Communication Planning

John Middleton and Barclay Hudson

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CHAPTER 1: OVERVIEW

The purpose of this paper is to look into the art and science of educational planning in search of lessons and models for the rapidly evolving yet comparatively undeveloped field of communication planning. This search is occasioned by increasing interest in the problems and processes of planning national communication systems, particularly in support of development and social change goals. The search is necessary because, as a new area of social planning, communication planning has yet to develop its own models and procedures. And educational planning, perhaps chief among all of the various social planning disciplines, comes close to communication planning in terms of common goals. Certainly, as we shall show below, there are several pragmatic, functional relationships between the two areas.

We have first reviewed the current status of educational planning issues, models and indicators, and processes. This review is presented in chapters two, three, and four. Chapter one presents a brief introduction to the paper, providing definitions and some initial thoughts on the relationship between education and communication as social institutions. Chapter five draws out lessons from educational planning for communication planners.

DEFINITIONS

Although the domain and nature of educational planning continue to evolve, it is possible to give a reasonably precise definition. Educational planning can be thought of as the development and statement of goals, determination of policy and program alternatives, assessment of costs and resources, evaluation of outcomes and effects, and the monitoring of allocation decisions and implementation activity for teaching/learning activity that is organized into programs, institutions and educational and training systems. The definition is broad; however, in practice the bulk of educational planning has been for formal school systems at relatively high levels of aggregation, often at the national level, particularly in developing countries.

Communication planning is more difficult to define. Parker writes about communication policy and planning in support of national development, and deals primarily with telecommunications, asserting that "development of a telecommunications infrastructure permitting the flow of information throughout a society may be the single most powerful engine of sustained development" (in Rahim and Middleton 1977). Beltran defines national communication policy as "... an integrated, explicit and durable set of partial communication policies harmonized into a consistent body of principles and norms addressed to guiding the behavior of institutions specialized in handling the overall communication process in society" in Rahim and Middleton 1977). In an extensive search of the literature for communication policy and planning, Rahim compiled some 400 entries covering "telecommunication, mass communication, extension and other organized interpersonal communication, new communications technology, and application of communication in development" (1976).

Hancock (1977, p. 5) defines communication planning as:

... the preparation of long-range and short-range plans (i.e., strategic and operational) for the efficient and equitable use of communication resources, and for the realization of communication policies, in the context of a particular society's goals, means and priorities, and subject to its prevailing forms of social and political organization (emphasis in original).

While this definition offers a good beginning, we must bear in mind that Hancock also defines "communication"

as the "... sum of those media channels and institutions which have a technological base." This somewhat restricted definition appears to exclude interpersonal communication, such as non-mediated formal and non-formal education. Thus it falls short of being a comprehensive statement.

FUNCTIONS

No completely satisfactory definition has emerged. But while we cannot precisely define what communication planning is, we can note four major functional areas that seem to concern communication planners, with the idea that the sum of these interlocking combinations of problems, communication systems and technologies may approximate the scope of "communication planning."

MASS MEDIA AND PUBLIC INFORMATION

The great print and broadcast media of modern society are what most laymen think of as "communications." Radio, television, newspapers, magazines and the cinema (and in China the wall poster) are the source of much of the public information flow in society. While we now know that the "obstinate audience" will not succumb automatically to mass media messages, (Bauer, in Schramm 1971) it is still clear that the mass media at the least have important effects in determining what people talk about (known as 'agenda setting' in communication research). There is also evidence that mass media advertising affects consumer behavior.

Something as important as this is extremely attractive for social planners, despite the considerable constitutional protection that traditionally surrounds these media in Western democracies and their imitators, and the relative independence of media institutions. Under other systems of government, of course, such protective barriers and institutional independence have not existed to the same extent. Thus we see development of policies regarding mass media, such as in Peru where a reformist government has expropriated the newspapers from capitalist ownership, and re-allocated their control to various social groups—peasants, workers, professionals, educators and intellectuals (Beltran, *op. cit.*). In India and Singapore, we find policy and planned action to use broadcast media in certain ways to promote national integration in multi-lingual societies (Chatterji 1974; Kuo, in Rahim and Middleton 1977).

TELECOMMUNICATION SYSTEMS AS SOCIOECONOMIC INFRASTRUCTURE

Another component of the communication system of society are the telecommunication systems—telephone, telegraph, short-wave radio—designed for two-way, interactive communication. These systems are important parts of national, social and economic infrastructure (Melody, in Rahim and Middleton 1977), providing channels for the flow of vast quantities of information, linking people and institutions together.

Rapid advances in telecommunications technology have led planners to take this infrastructure much less for granted. Satellite distribution for telephone and print messages (as well as broadcast media) has greatly increased the reach and potential of these media, raising in the process issues of control across national boundaries (Richstad 1977, p.3). Other technical advances, such as optical fiber and laser, promise a significant increase in the capability of systems to carry a high volume, and potentially great variety, of messages. Cable television systems greatly expand the number of channels, and make possible community access to a broadcast medium long controlled by a few central private (or public) institutions.

In most societies these systems have been subject to regulation, a form of policy planning, although this policy development is often diffuse and uncoordinated, as in the United States (Polishuk 1976). Planning for the effective use and growth of these systems and technologies is a major concern of communication planning.

COMMUNICATION FOR DEVELOPMENT

There has been a great deal of practical experience with the purposive (and often persuasive) use of communication systems of all kinds in support of social and economic development programs, both in developed and developing countries (see Susanto, in Rahim and Middleton 1977). Well-known examples of this include extension services and multi-media campaigns designed to share information and/or to alter behavior (as in family planning). Communication of this type has involved a certain kind of planning (Boyd 1975; Middleton and Lin 1975).

The functions of telecommunication systems in support of development are also of central concern. Hudson and Parker, for example, draw attention to the importance of telephone systems in development efforts (1975).

COMMUNICATION FOR EDUCATION

Finally, there have been many applications of communication technology to the processes of teaching and learning, in both formal and nonformal settings. Planning has been an explicit part of this work. That

educational planning and communication planning cross paths in what may be called "instructional technology" or "educational communication" was demonstrated some years ago by the publication of a series of volumes on the new media and their implications for educational planners by the International Institute for Educational Planning (UNESCO, 1967). This intersection of interest between educational and communication planners has formed the major link between the disciplines, and is a rich source of literature on communication planning processes and procedures (see for example, Schramm 1977; Hornik, *et al.*, 1973; Morgan and Chadwick 1971; Ingle 1974).

COMMUNICATION AND EDUCATION AS SOCIAL INSTITUTIONS

Since our purpose is to see if social planning and techniques from one discipline have value for another, it seems useful to compare the two disciplines in terms of the social institutions with which they are associated. Such a comparison, however incomplete, may be helpful as we look at the techniques and procedures of educational planning, enabling us to keep in mind some of the major differences, as well as interrelationships, between education and communication systems in society. While many categories of comparison are possible, three that seem helpful in this context are relationships of power, structure, and function.

POWER RELATIONSHIPS

Education is an established part of society in both developed and developing countries. Its power relationships are well-defined, beginning with relationships between teacher and pupil, administrator and teacher, and so on up the administrative ladder. Though the exact form of these relationships differ by society (from the decentralized systems of the United States and Canada to the centralized systems of Korea and France), the organizational power structure within which communication takes place, instructional or otherwise, is usually clear to the participants. And despite the efforts of reformers, it remains essentially an unequal relationship, in which one knows, and one does not; or in which one has more administrative authority or professional expertise than another. At best, the communication relationship among individuals or groups within the education system is contractual, with fixed parameters in time and space. Teachers agree to instruct according to the syllabus; pupils agree to "learn"; successful pupils are passed on in the system at regular intervals, and may be found in predictable places. Similar relationships exist for teachers and administrators. Even many nonformal education structures imitate this model. Literacy classes meet on schedules, with teachers. Vocational training programs within industry are often highly structured. The effects of this highly structured system on "modernity" have been recently discussed by Inkeles and Smith (1974).

That power relationships are well established, defining the boundaries for communication relationships, has enabled educational planners to focus on the shape, functions and costs of their system with rather formal models.

Communication, on the other hand, is at once less well defined and more pervasive than education. To paraphrase Schramm (1971), it is the flow of information in society through inter-personal and mass media, it is the organized effort to persuade or teach, it is entertainment. The power structures of communication are quite different from education. With the exception of formal education, communication takes place in situations of relatively equal power among participants. One can tune in or out; answer the telephone or hang up; invite the extension worker in or out; open or close the newspaper, scan or read closely; attend or not attend a community meeting; go to the library or not, and while there browse, select, read, checkout one of many books. There seems to be relatively greater freedom in communication; less of an accepted, structured power relationship.

We must emphasize the word relative. Communicators, and communication researchers, put a great deal of effort into studying and understanding audience behavior in order to gain attention to and intended interpretation of messages. This effort appears to exceed in scope and intensity efforts by educators to "motivate" their captive classroom audiences, but the two are parallel. To persuade is to attempt to establish a power relationship. Thus we are talking about a matter of degree, although the difference may be important for evaluating educational planning models in light of the needs of communication planners.

STRUCTURAL RELATIONSHIPS

Education and communication have, apparently, accomplished the remarkable feat of being simultaneously part of each other. To explore this idea we must set some of the parameters of each as social structure.

Let us begin first with education. The core structure is the formal education system of a country or

* If this seems a doubtful assertion, consider the volume and cost of media advertising, and the size of the advertising industry.

other, smaller area. This system is complex, to be sure, but relatively static. It is defined by social consensus on function and well-established power relationships. Its comparative simplicity may be seen in many of the formal models used to describe it, including the educational "pyramid," which portrays the system in terms of levels of education, showing where members of each age cohort are expected to be at any point in time. The first great wave of models in education planning (as we will see below), described the flow of students and teachers through this structure, emphasizing economic and social costs and benefits of different flow patterns, including expansion of all or part of the system.

People enter this structure at various stages of life, progress, graduate or drop out. The time and space boundaries are well defined and understood. Thus education is a definable sector in society (and is treated as such by economic planners). With few exceptions, one can identify educational institutions and aggregate them as a more or less well integrated sub-system of society, articulated in roughly definable ways with sectors such as agriculture, industry, health. Virtually every country has a national Ministry or Department of Education.

Despite common assumptions to the contrary, communication is not synonymous with mass media. Communication, as its scholars are proud to proclaim, is everywhere. It is the "great relational tool," (Schramm 1971), the basis for social relations and order.

Thus it is in all sectors, including education. At the micro-level, it is the interaction between a teacher and a student. At an organizational level, it is the flow of order, response and feedback along the chain of educational command and the telecommunication which makes this possible over wide areas. It is public relations for the educational system with the larger society. It is the use of media of mass communication for instruction. The processes and media of communication are embedded in the educational system.

Yet when communicators think at societal levels, they see education as part of the national communication system, functioning in the crudest sense like one of the great mass media (Sobhan, in Rahim and Middleton 1977; Kline, Middleton, Perelman 1976).

Efforts to describe the communication "sector" in society have only just begun. However, Porat (1976) has shown that the information industry in the United States accounts for 45 percent of all jobs and 53 percent of all labor income. Although Porat's definition of the sector may be challenged as too broad, his findings provide evidence that a public/private communication sector can be defined, and that it is a major component of modern society. Application of Porat's scheme to developing countries would undoubtedly show communication to be a smaller, yet rapidly growing segment of the economy. Not incidentally, Porat includes education as an "Information Distribution and Communication Industry," classifying it with libraries and the great mass media.

Thus, in sum, communication processes and media permeate education as a social institution. Communicators, in turn, look on the formal education system as part of a larger, national communication system.

FUNCTIONAL RELATIONSHIPS

There are at least two broad ways of looking at education, communication and society in terms of functional relationships. One is to look at the relationships of communication and education to broader society. The other is to look at the relationships between the two "sectors."

As implied above, and discussed in greater detail in the review of educational planning below, functional relationships between education and society can be described. In the broadest, most humanistic sense, education is the universal good, necessary for a full and satisfying life. Since Plato's Republic, at least, education has also been viewed as preparation for participation in the social and political order. Modern educational planners have taken this last relationship further, defining it more narrowly in terms of preparation for work. This last definition has enabled educational planners to define functional relationships in economic terms (however imprecise), making possible competition for resources with other sectors.

Functional relationships between communication and society seem less clear. Certain rights to communication are defined in constitutions (i.e., free speech and press). Correlations have been established between growth of media systems and economic development (Schramm and Ruggles 1967). Other communication behaviors (i.e., mass media exposure, literacy) have been linked to "modernization." (Inkeles, Smith 1974; Lerner 1958). Specific applications of communication can, on occasion, be defined in more functional terms, primarily in support of specific development projects. In this last instance, changes in information levels are presumed, with relatively little evidence, to lead to attitude and behavior changes, the latter having functional value. Overall, however, functional relationships between communication systems and society at large seem less well defined.

It is helpful to think of the relationship between the formal educational system of a nation, and a larger national communication system, also in two ways. First, as we have noted, the formal educational system can be seen as a major component of society and, by definition, of the national communication system. As such, it both contributes to the flow of information in society and determines much of the societal context within which a national communication system functions. Thus planning for a national communication system (or systems) can include all planning for education, and must include planning that takes into account the effects that formal education has on broader social communication.

The second relationship between communication and education centers around use of communications technology for instructional purposes. This is a narrower concern, more easily dealt with by planners in the sense that much more is known about the communication/education interaction at this level.

Figure 1 is a first attempt to model functional relationships between formal education and the broad, yet-to-be defined entity known as the "national communication system." Neither education nor communication is portrayed in any detail. The purpose of the structure is to give direction to future thinking about the utility of educational planning models for communication planning.

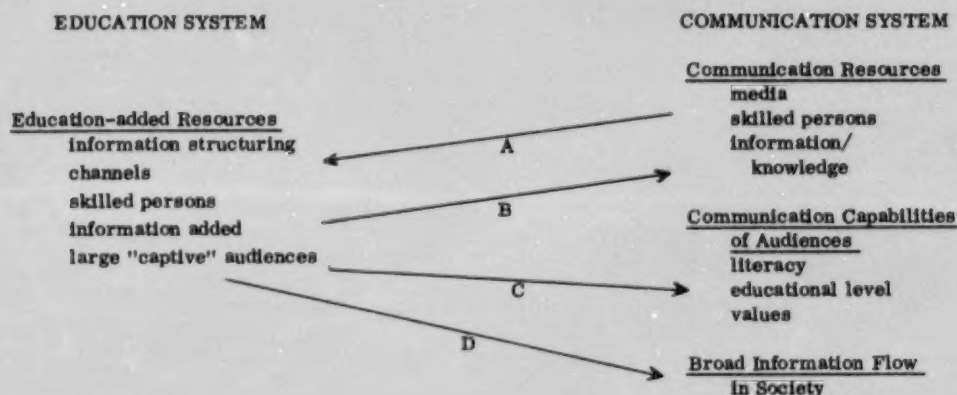


Figure 1. Education/Communication System Relationships

A few comments on the model may help. Education is seen as having three primary functional relationships with the communication systems. The first is as a consumer and producer of communication resources. The duality of this relationship stems from education's capacity to add value* to existing communication resources by structuring information, and by providing formal, well-established channels for communication flow. The education system further supports communication by adding skills to already skilled manpower, by producing skilled persons in the first place, by adding information (knowledge), and by providing a large "captive" audience of students, teachers and administrators who can form a significant proportion of the total population (relationships A and B).

These added values in turn become inputs into the communication system in at least two additional ways. First, they determine much of the communication capabilities of national audiences (relationship C). The formal educational system has first crack at establishing literacy (and may, through formal adult programs, continue to work at it); determines the general level of education of various audiences, establishing much of base for perception and interpretation of information; conserves, transmits and establishes values which in turn affect communication behavior. Second, the formal system provides a significant portion of the information flow in society, not only to students and teachers, but through "multi-step flow" (Schramm 1971) and various school-community organizations, to adults as well (relationship D).

* We do not mean "added value" in the strict economic sense, although the term fits well. We are referring to the potential of schools to focus and increase the intensity of information (i.e., through practice) in such a way as to increase the probability of the information a) reaching its intended audience, b) in the desired order, and c) having intended effects.

In sum, we have noted that, unlike its relatively mature cousin educational planning, communication planning has not yet been fully defined. Issues associated with communication planning include the intimate relationship communication has with all aspects of society, a growing record of efforts to plan and order communication systems and relationships to inform and to modify the behavior both of individuals and social systems, the rapid increase in communication technology, and utilization of this technology in support of teaching/learning activities, often in formal school structures.

We have begun to explore the relationships between education and communication in society, comparing the two in terms of power, structural and functional relationships. Education and communication are seen as interlocking at different levels in different ways. Two particularly important relationships lie in the communication planner's view of the education sector as a major mass medium in society; and in the education planner's view of communication technologies as resources to be used within the educational system.

If we conceive of the long-range task as weaving a conceptual fabric called communication planning, the ideas briefly outlined above may be thought of as several of the many threads which must eventually be fit together in a new pattern. Some of the ideas, notably those about communication systems, might also be thought of as the pieces of the loom on which the fabric will be constructed.

In the following chapters we will review the science and art of educational planning of the mid-1970s.

CHAPTER 2: EMERGING ISSUES IN EDUCATIONAL PLANNING

INTRODUCTION

Educational planning is no longer as well defined a field as it used to be. "Ten years ago," said a senior staff member at the International Institute for Educational Planning (IIEP), we felt confident in drawing up a list of issues and research priorities for educational planning. Now everything is fuzzier." The assumptions of the old models are increasingly coming under fire. The shift from clearcut economic criteria to broader social goals in national development makes it more difficult to plan with clearly defined objectives in view. Techniques proliferate, some based on unorthodox concepts of social science. Experience shows the need for better integration of formal planning methods with political processes bearing on implementation of plans, dragging methodologists into questions of ideology. There is new talk of "learning societies," which move educational processes and planning functions out of specialized institutions into society at large--factories, mass media, action campaigns, storefront community groups. In this sense, perhaps the single greatest shift in educational planning in the seventies is the sense that, for better or worse, the boundaries between educational planning and other social processes are breaking down.

Consequently, making sense of educational planning requires some backtracking to the fundamentals. "Planning" can be defined as foresight to generate social action toward articulated objectives. "Foresight," "action," and "objectives" can be treated with varying mixes of unquestioned assumptions, focused calculation, informed judgment, systematic doubt, or programmatic research, depending on the planner's biases, methodological toolkit, available data, sponsorship, and local circumstances for putting plans into effect.

When applied to teaching/learning activity that is organized into programs, institutions, and education and training systems, comprehensive and systematic educational planning covers the development and statement of goals; determination of policy and program alternatives; assessment of costs and resources and evaluation of outcomes or effects; and the monitoring of allocations decisions and implementation activity. Results of this last step are fed back into what is a continuous process. This is the rationalistic view of educational planning (Hudson, Davis *et al.* 1976, p. 7). There are other planning traditions, including transactive planning, advocacy planning, radical planning, and disjointed incrementalism. These rely more on building up and outward from small-scale experiments. Whereas rational planning builds on codified knowledge, and comprehensive, sequential analysis with goals, program alternatives, evaluation and implementation, in contrast, the other, less conventional versions of planning emphasize intuitions, skills, and continual adjustment within specific social contexts. The present state-of-the-art review mainly deals with the more conventional "rationalistic" tradition of educational planning. It will become apparent, however, that there do exist alternative planning styles--that is, alternative techniques, cognitive models, epistemic bases, communication structures, ideological premises, and alternative assumptions about the nature of society. Moreover, some of these alternative styles of planning have major contributions to make in response to particular issues emerging on the educational planning scene, both in enriching the repertoire of available methods and in articulating substantive questions about the role of education in society.

The present review does not offer a clear distinction between educational planning as carried out in the United States *versus* planning in other countries, especially as major work in U. S. institutions relates to developing nations. Among the roughly 800 institutions listed by the U. S. Office of Education in its 1976 Education Directory, only a half dozen are categorized under the rubric of "educational planning." A notable inclusion is the International Institute for Educational Planning in Paris, whose Unesco affiliation and worldwide connections in training, research, consulting, and clearinghouse functions make it probably the most representative institution of educational planning from which to judge the state of the art. IIEP itself publishes

occasional bibliographies, inventories of research needs, and institutional directories. Its 1964 directory listed 18 educational planning institutions for the United States, including 15 university-based programs, the East-West Center, the Brookings Institution, and the Ford/Carnegie-sponsored Inter-University Study of Labor Problems in Economic Problems.

Traditionally, educational planning has comprised three basic approaches: (1) estimation of social demand, (2) manpower planning, and (3) cost-effectiveness analysis (Blaug 1967; Roger and Rucklin 1971, p. 224). This can be extended to a broader list of about 20 themes, based on a review of recent publications addressed to the question of new issues in educational planning, (IEP 1970; IEP 1976; OECD 1973; IDRC 1976; Unesco 1970; Faure 1972; Platt 1970). Eleven of these themes are mentioned by only one or two sources, * but nine issues were cited with greater frequency: the three "classic" issues already mentioned: (1) social demand, (2) manpower forecasts, and (3) cost-effectiveness, plus (4) integrated planning, (5) planning at local levels, (6) lifelong education, (7) equity, (8) work-relatedness of education (problems of the well-educated unemployed), and (9) the broader context of development objectives and ideology. A tenth issue, nonformal education, emerges because of clear linkage with communication planning issues. Each issue is briefly reviewed here as background for the consideration of models and strategies in succeeding chapters.

SOCIAL DEMAND

Forecasts of social demand for education are usually based on demographic analysis, involving survival rates for age-group cohorts. Other factors beside the population profile have an effect on the effective demand for schooling: income levels and distribution, private costs of education, non-formal schooling opportunities, job markets and requirements, shifts in cultural norms, military draft (or its avoidance), political pronouncements affecting social expectations, and the local accessibility of educational opportunities. In practice, however, most of these refinements are ignored. University application levels, for example, are especially sensitive to nondemographic factors, but adjustment tends to be reactive rather than anticipative based on advanced planning. Major demand shifts have occurred at lower school levels chiefly in times of significant political change. Indeed, widespread demographic-based planning became prominent at the time of Unesco's involvement in educational planning for newly independent nations during the sixties, and student and teacher flow models were important early components of educational planning methodology. Among industrialized nations, long-range forecasts are important especially when the population profiles show discontinuous strictures or bulges (Morrison 1976). Small variations in student numbers at a particular level of education can increase, by whole orders of magnitude, the demand for flow of new teachers to that level, which partly explains the tendency for periodic gluts and scarcity in the market for teachers in the United States.

In sum, demographic analysis continues to have an important role as a nation moves from lower to higher stages of development. Fluctuations get smaller, but data improvements allow greater precision in forecasts. More research is needed, however, on the sensitivity of demand for education in response to factors other than demographic pressures.

MANPOWER PLANNING

This approach generally involves the projection of gross economic targets, which are then broken down into sectoral needs and translated into job requirements through industrial-occupational matrices. Educational plans can then be based on the estimated gap between future occupational needs and projected manpower supplies, adjusted for migration, death, and retirement.

Some versions of this approach use highly aggregate categories. Tinbergen and Bos (1965), for example, calculate only the relative proportions of graduates needed at primary, secondary, and post-secondary levels of education as a function of gross levels of economic development. Other studies focus on detailed analysis of particular sectors and highly disaggregated occupational categories. The U. S. Department of Labor, for example, issues an occasional bulletin, Occupational Manpower and Training Needs, covering 240 occupations, estimated to make up about two-thirds of the 1985 labor force, and focusing mainly on skills needing the most advanced training, (see U. S. Bureau of Labor Statistics [U. S. BLS] 1974). Most manpower planning in the United States is done at the state and metropolitan levels, but they receive technical assistance from federal agencies, and the U. S. Congress has stipulated that federally-financed training programs be based upon prior assessment of relevant manpower needs (U. S. BLS, p. 1).

Several current developments in the manpower planning literature deserve note. One is increasing

* These include issues of new educational media; innovation more generally; case study analysis; problems of rural and poor areas; public participation in planning; higher education; long-range futures; management and administration (problems of plan implementation); cost and finance; and evaluation.

recognition of manpower planning and benefit-cost analysis as complementary approaches to the same problem, especially when the focus is on specific occupational and training categories. Consequently, they deserve integrated rather than separate analytical formats (see Somers and Woods' Cost-Benefit Analysis of Manpower Policies 1969; also Hardin and Borus 1971).

Secondly, increasing attention is being given to labor market processes as mediators of manpower policy outcomes. Markets importantly define the geographic units for analysis, the level and flexibility of industry/occupation training coefficients, and the "permeability" of economic activities to new trainees. Theories of labor market segmentation, in particular, help explain why training programs for "needed" occupations often fail to help the unemployed find jobs (see Levitan, Mangum and Marshall 1976; Doeringer and Piore 1971; Doeringer *et al.*, 1972).

Third, there is scattered writing on the adaptation of production processes to accommodate available manpower, rather than vice versa (IIEP, 1970). This is discussed in the section on nonformal education.

Finally, it is recognized that there are many mechanisms that can complement or partially substitute for manpower planning. These include price mechanisms in the labor market, non-formal training, early warning "glut" and "shortage" indicators (such as ratios of jobs to applicants), use of education as a "holding institution" for people out of work, adjustments of formalistic job requirements, government investment projects geared to absorbing redundant skills (especially as part of counter-cyclical fiscal spending projects), adjustments in work-week, selective enforcement of immigration policies, adjustments in Armed Forces preparedness levels, military training, encouragement of exit or entry into the household sector (especially among teenagers, women, and workers over 60, as marginal members of the labor force), short-term counseling, on-the-job retraining, training for more adaptive work attitudes (as opposed to cognitive and manual skills), facilitation or inhibition of work entry (creation of counter-incentives to work being a major issue in welfare reform), energy and technology incentives affecting labor-absorbing industries, worker sabbaticals, control over labor-market "gates" (unions, professional associations, political and social contacts, racial discrimination), home study courses (5 million Americans enrolled in 1972, according to the BLS 1974, p. 21), VISTA-type service programs, varying rates of absorption into illegal economic activities, and general media reports on new economic opportunities or problems of occupational joblessness. The list could go on.

With all these mechanisms at work, one might well ask, "Why are manpower plans needed at all?" Evidently, manpower forecasts are useful where the "gestation period" for specific skills is very long (*e.g.* doctors); where there is need to coordinate creation of jobs *pari passu* with new skills (*viz* the pattern of emigration among highly skilled occupations from poorer to richer nations); and where the data exists for this kind of planning. The need for manpower planning is perhaps greatest in less developed countries: the gaps between supplies and needs are large; key occupations for "modernization" may require educational changes all the way down to elementary school; and there is likely to be a weaker infrastructure of short-term adjustment mechanisms. The problem is, lesser developed countries generally have fewer resources for putting plans into effect, poorer data to work with, and less resources to pay skilled graduates in competition with foreign markets. (Jamaica, for example, regularly exports more post-secondary graduates than it produces.) Does manpower planning pay off, then? The answer must come in part from scrutinizing manpower policies within a complementary framework of educational benefit-cost analysis.

COST-EFFECTIVENESS ANALYSIS

Issues of educational cost-effectiveness can be addressed by various methods, including benefit-cost analysis, rate of returns analysis, estimation of educational production functions, flow models, linear programming techniques, and goals-achievement matrices. Some of the underlying analytical models are discussed later. Here, the chief concern is with general trends in the application of cost-effectiveness approaches, and the kinds of new questions being raised about educational "effectiveness" in particular.

It is traditional to look at "costs" in terms of monetary resources, and "effectiveness" in terms of one or more quantifiable measures of progress toward specific objectives (see Figure 2). For actual policy decisions, however, the operational considerations might be exactly the reverse: the most important costs may turn out to be non-monetary costs incurred as side-effects of the intended outcomes; meanwhile, the political push for program implementation may hinge upon monetary benefits to implementors, as distinct from actual services delivered to the ultimate client.

	Type of Factors to be Considered in Computing Cost-Effectiveness		
	Monetary	Other Quantities	Qualitative
Costs	(1)	(3)	(5)
Effectiveness	(2)	(4)	(6)

Figure 2. Factors in Cost-Effectiveness

During the sixties, considerable research went into estimating the monetary rate of returns to different types of educational investments. Most studies recognized, however, that many educational benefits cannot be monetized. Consequently, work has tended to shift from cost-benefit to cost-effectiveness studies, involving non-monetary objectives. Some authors emphasize meeting fixed targets at least cost, others the maximization of objectives subject to fixed cost constraints. In either case, cost-effectiveness analysis shifts the emphasis to questions of economic efficiency in undertaking educational missions, beyond the more fundamental (but often politically redundant) question of whether to undertake a mission in the first place.

The PPBS approach, popular in the late sixties, reflects this "mission"-oriented approach. Despite its numerous critics (such as Hoos 1972), the basic concept of PPBS is kept alive under various newer guises, such as MBO (Management by Objectives), the Logical Framework approach (used by AID in educational planning), Zero-Based Budgeting, the Goals-Achievement Matrix approach (Hill 1968; Lichfield 1970; Hudson 1975), and other formats. These will be discussed in the chapter on methodologies.

Social demand analysis, manpower needs estimates, and cost-benefit analysis have made up the core of educational planning since the early sixties. Almost from the beginning, though, other issues have been addressed, largely in an attempt to bridge the varying perspectives of the economists and the educators; the planners and the administrators; the people with long-range models and those with day-to-day problems to contend with. This raises the next series of issues for discussion.

INTEGRATED PLANNING

This refers to coordination of plans and practices among different educational programs and related activities. Often, it refers to coordination between primary, secondary, and higher-level education. Higher education has a tradition of autonomy from state control in most countries, but as college education becomes what high school used to be--a democratic right rather than a path for the chosen few--it has increasingly come under state sponsorship and control (Halsted 1974). In the United States, state and federal planning for higher education received major impetus under the Morrill Land-Grant College Act (1863), and again under the Higher Education Facilities Act of 1963. War-time government contracts with universities also set the pattern for close coordination of academic programs with industrial, military, and other governmental programs, to a degree found in few countries outside the United States (Kerr 1954).

The concept of "integrated" planning also refers to overall educational reform, with attention not just to quantitative targets, but curriculum overhaul and new infrastructure--for example, management, program evaluation, and textbook production facilities. In some cases, "integrated" planning refers to the linking of long-term plans and short-term implementation, particularly through budgeting planning. PPBS follows logically from this concern. (On implementation of plans, see Pressman and Wildavsky 1972; Correa 1975.) Another form of integration refers to the coordination of educational planning, or with regional and local development plans.

LOCALIZATION OF PLANNING

The mid-seventies witnessed a decisive shift of educational planning roles in the United States from federal to state and local agencies, particularly in manpower planning. In some cases, SMSA's (Standard Metropolitan Statistical Areas) have been delegated planning authority, since these represent logical units for defining labor markets (U.S. BLS 1974). In previous decades state-level control meant quite the opposite--an attempt to bring central control over otherwise uncoordinated local institutions (see Halsted 1974). More recently, however, with revenue-sharing under the Nixon administration, and the push to decentralize Washington programs under President Carter, state- and SMSA-level planning will likely receive yet another impetus.

Particularly in the context of planning for developing nations, there is another aspect of localization, which goes beyond the downward delegation of authority from central to local experts: there is expression of a need for two-way communication, and planning from the "bottom up." This means, in part, learning from local initiatives rather than imposing glamorous innovations from the outside (Unesco 1970). In addition, it reflects a growing appreciation that planners must occasionally touch base with day-to-day realities in the lives of people targeted for improvement (Hudson et al., 1976; Raper 1970; Coombs and Ahmed 1974; Anderson 1973; Hampden-Turner 1975; Goulet 1971). Edgar Dale once observed that the most important ingredient in education is "to enter sympathetically and imaginatively into the lives of others" (in Tyler and Williams 1973, p. 31). The same dictum is now being applied to educational planners as well.

More generally, the increasing emphasis on localization of planning reflects the gradual diffusion of planning skills, political thrusts toward democratic participation in the planning process, and increasing suspicion that planning models based on highly aggregate data are invalid unless the parameters are "tuned" to local conditions.

LIFELONG EDUCATION

There are several confluent lines of thought on lifelong education. One derives from the idea of work-based education (see Davis and Lewis 1975). Mincer (1962) has estimated that for the male labor force, on-the-job training is as important (in terms of the size of educational investment) as formal schooling, with a comparable social rate of return. Adelson (1971) has examined differential work settings that (apart from capital infrastructure and often without deliberate planning at all) serve to enhance human capital over time, as compared with work settings where human capital "depreciates." Swedish experiments in worker-managed production processes also suggest the importance of treating jobs, education, worker capabilities, and career possibilities as processes in continual evolution, and not as fixed in a once-for-all certificate of competence (see Grassman 1972).

Another premise for the concept of lifelong education derives from the research findings on educational production functions, such as the Coleman Report (1966), showing that inputs associated with formal schooling could only account for a minor proportion of cognitive achievement levels. The effect of the larger social environment has become more prominent in the literature (see, for example, Jencks et al., 1973), and lifelong education can be interpreted (in part) as an attempt to design that larger environment to enhance learning in ways that formal schooling cannot.

Lifelong education responds also to the realization that people shift jobs in mid-career, often more than once. In affluent societies, moreover, education can be considered a "consumption" good, and not just an "investment in human capital" (as educational planners used to speak of it, from the economic standpoint of allocating scarce resources). More people are returning to college and university programs which they could never afford to complete when younger.

Finally, lifelong education makes sense with the development of non-traditional forms of education--correspondence courses, "open universities" (following Britain's lead), non-formal education, educational television and computer-aided instruction, and increasingly diversified training programs in the military more open now to women and minorities than in past decades. More favorable social settings for lifelong education can also be seen for the future: worker sabbaticals (now being experimented with in Sweden--see Grassman 1972), wage subsidies for the hard-core unemployed (which provides a built-in incentive for firms to raise productivity among those workers hired), shorter work weeks and longer vacations, computer-aided "networks" of part-time teachers and learners seeking ad hoc extension-type courses, and stronger roles for government in creating jobs.

This leads to a final set of educational issues. They relate less to education as an isolated activity, than to the responsiveness of education to specific problems of social and economic development in the seventies.

EQUITY

The distribution of educational opportunities is a recurrent theme in the planning literature. Often, it appears as simply one item among a list of other educational objectives (see the present review). Occasionally, reference is made to specific social movements which give "equality" realistic force as a touchstone of social policy. (The 1974 Annual Report of the U. S. Commissioner of Education mentioned equality in reference to then-current developments in promoting the rights of women, and there has been, indeed, a recent surge in the proportion of women seeking jobs (see U. S. Office of Education 1974, p. 7).

The general shift of the seventies has been away from economic growth as a planning objective toward social objectives--social justice, provision of basic needs, quality of life (Faber and Seers 1972; Faure 1972;

Dag Hammarskjöld Foundation 1975). The shift has perhaps been manifested more in rhetoric than action, but one sees promising signs: Tanzania's Declaration of Arusha (1967) was an explicit acknowledgment of the biases of that country's first Five Year Plan toward greater social inequality, and it attempted to deal with this problem by a radical shift in priorities, not least in the field of education. The IIEP has recently identified equality of opportunity as a major research theme to be pursued in the late seventies (IIEP Bulletin, No. 1, September 1976, p. 1). International technical assistance agencies, including OECD, the World Bank, UNDP, Unesco, and AID are focusing more explicit attention on the "Fourth World," variously meaning the "25 poorest" nations (characteristically small and landlocked) or the "35 most seriously affected" (those without a share in the growing political strength of the Third World for lack of oil and mineral resources to bargain with). There is also new recognition of the role of More Developed Countries in hindering more equitable development, through exotic development programs favoring the already-rich (see U. S. General Accounting Office 1973), technology biases (Dickson 1975), inappropriate consumption standards (Schumacher 1973), arms exports, control of media, trade policies, and other indirect policies. Some agencies carrying out research on these issues have also sought ways to inject their findings into policy making processes. The Economic Commission for Latin America was a forerunner in this tradition; more recent examples are the Intermediate Technology Development Group (London) and the Science Policy Research Unit, based at Sussex University.

One of the most significant contributions to the equity issue came out of the Coleman Report (1966). Contrary to most expectations, the Coleman analysis found that minority (i.e., non-white) populations were not facing a major problem of unequal treatment in terms of access to educational resources (at least as measured in this study). Yet minorities were found to be lagging further behind in achievement with every increment in years of schooling attained. In view of these findings the authors of the report took a major step in redefining equality to mean equal educational outcomes, and not simply equal exposure to educational inputs (teachers, books, classrooms, and other learning facilities). The report also identified as a key variable determining educational achievement the student's sense of efficacy, or control over his/her destiny. This signifies a broadening of educational planning to address other factors in the student's environment besides schools that affect achievement, particularly factors determining the sense of being "an effective person."

These developments are another example of the blurring of lines between educational planning and the larger context of policy making for social transformation. This is seen in another educational issue which has come to the fore in recent years--the connection between education and work opportunities. The problem addressed here is the gap between schools and jobs that manpower planning has failed to bridge.

WORK AND WORLD VIEWS

The U. S. Office of Education Annual Report (1974, pp. 5-7) cites a current Gallup survey on why people want education for their children. The first reason given is "to get a better job." Reflecting a similar concern, the Faure Report (1972) proposed a shift in emphasis of educational planning away from aggregate economic objectives toward more specific social objectives with major attention to employment. This concern seems to have arisen from the growing evidence that unemployment can persist even among persons with advanced training geared to national needs. According to Turnham and Jaeger (1971) the average education of the unemployed has been rising in less developed countries. With this problem in view, Edwards and Todaro (1972) have made a strong plea for educational investments complemented by parallel investments in job-creation activities.

There is a growing amount of literature on labor market analysis and manpower policy, reflecting perhaps three distinct schools of thought. * The neo-classical approach holds that employment problems arise from the individual's lack of competitive edge in the labor market. Concepts and analysis derive from the queue theory of labor allocation. There is some recognition of business fluctuations as a source of the problem, but policy emphasis is on training and other forms of "human capital formation."

A second approach focuses on the segmented character of labor markets (see Cain 1976). Piore and Doeringer (1971) refer to dual labor markets, Okun (1975) to a "two-tier" model, Bluestone (1970) to a tripartite market (core, peripheral, irregular), Levitan, Mangum and Marshall (1976) to a "multiple" model (professional, mainstream, marginal, and submarginal). All emphasize the demand side of the labor market, and tend to see training as part of a larger policy package, including job development, job restructuring, design of new careers, wage subsidies, anti-discrimination measures and affirmative action, and public service employment.

A third school of analysis builds on the segmented labor market approach, but focuses on the more

* The subsequent three paragraphs reflect work underway by Kathy Van Ness, a doctoral candidate in Urban Planning at UCLA. Her help is gratefully acknowledged.

pervasive social political and economic structures governing labor markets. This radical (or structural) school emphasizes the importance of class differences and capitalist social organization in explaining the failure of marginal workers—even with suitable training—to be absorbed into the economy. Policy recommendations emanating from this school are not clear, short of major social transformation or the generation of ideologically-based social movements committed to finding solutions within well-bounded territorial communities. (The Watts Labor Community Action Committee is a possible example (see Hampden-Turner 1975). One theme often expressed by radical analysts, however, is the impossibility of purely local solutions, particularly given the role of multinationals in modern economic systems.*

Such issues may appear tangential to educational planning, nevertheless, questions of ideology and worldview, and their underlying theories of social and economic development, have come to be seen as inescapable issues of planning for the seventies and eighties. It behooves educational planners therefore, to acquire increasing sensitivity to the context in which plans are formulated and implemented. Policy is not cast simply in the mold of technical formulas, but is hammered out of contending social priorities, untested theories of social change, and unspoken ideological positions. This leads to the next educational planning issue to be considered.

DEVELOPMENT CONTEXT

John Simmons (1974) has argued that there are three basic theories to describe the effect of education on individuals and the economy, each with distinct implications for educational planning. The human capital theory has tended to dominate thinking in the planning field; emphasis is on the satisfaction of individual preferences, the cognitive effects of schooling, the effect of education on productivity and wages, and the possibilities of education thereby to reduce social inequality. The progressive theory recognizes the effect of schooling on noncognitive outcomes, and the importance of molding preferences toward shared social objectives. Policy implications extend beyond mere training to educational reforms that equalize opportunities and encourage personal growth and creativity. The structural theory holds that in an industrial society, there are basic contradictions between the production of a work force (the primary function of education) and the fullest development of individual capacities. Schools mirror the social relations of the work place: stress is on cognitive over affective modes of response, discipline over spontaneity, subordination over the taking of initiative, and acceptance of external rewards (grades, economic remuneration) in place of personal satisfaction. The policy implications of this theory suggest that "basic changes have to be made in the structure of the firm and other economic mechanisms before the dysfunctions of the school system will disappear" (Bowles 1974, p. 9).†

This is not the place to review these theories in detail or to comment on their merit. It is important to note, however, that educational planning, which a decade ago mainly addressed the problem of human capital formation, now finds itself addressing the political and social context of development more explicitly (see Hallak 1975). For example, in a nation giving major emphasis to self-reliance, like Tanzania, educational planners will have different objectives, data needs, and programmatic options to deal with than planners in other countries. (On the role of education for self-reliant development see Breeden 1970; the Dag Hammarskjöld Foundation 1976; Hudson *et al.* 1976; Anderson 1973).

There are also major differences in overall strategies of social/economic development that directly bear on educational planning. The distinction between "top-down" and "bottom-up" planning has received considerable attention since the late sixties, and implications for educators are beginning to be drawn out, particularly for the less traditional "bottom-up" approach (Hudson *et al.* 1976).

In sum, educational planners are having to come to grips with ideological conflicts—excellence vs. equity, local needs vs. national needs, self-reliance vs. interdependence. Resolution of these conflicts begins at the level of politics, but it also hinges around the design of educational processes, the social commitment of individual teachers, and the social institutions which employ (or discard) graduates of the system (see Pearl and Reismann 1965; Bowles, Gintis, and Simmons 1976; Dore 1975). Planners can rarely speak of the school anymore as a closed system or separate entity. Educational planning is becoming to be seen more realistically as a process woven into the larger fabric of social forces for change or preservation of the past. Closely associated with this view is increasing attention to nonformal education.

* Multinationals, apart from controlling strategic resources, lack the territorial identity to impel a sense of responsibility or political accountability to the communities they affect.

† Note the parallel between theories of education and theories of the labor market referred to earlier.

NONFORMAL EDUCATION*

A state-of-the-art assessment of nonformal education (NFE) is very elusive for several reasons: it is a catch-all term for everything that formal education is not; it addresses most of the issues related to planning of formal education; a main virtue of NFE is its adaptability to variations and evolution in local conditions; at its best, NFE is so deeply embedded in social and economic processes at large that a "state-of-the-art" for NFE virtually becomes synonymous with assessing general progress in society at large (see Dunn's "learning metaphor" for social and economic development in Dunn, 1971).

Axinn (1974, p. 121) has defined NFE as "any instance of knowledge, skills, or attitudes transmission taking place outside the formal education system." But he also entertains a "radically different point of departure" which views the definition of NFE as specifically bound to particular functions or missions of teachers and learners, usually within a developmental context (1974, pp. 3, 7-13). Much of the NFE literature addresses this instrumental facet of NFE, stressing the "investment" component of education rather than the "consumption" element. Coombs and Ahmed's work for example, is based on "a functional view of education, in contrast to the structural and institutional approach used in most educational planning and administration (1974, pp. 7-8).

On the other hand, it is important to recognize that much of the NFE literature addresses a broader range of issues, paralleling those in formal education.

Part of the popularity of NFE is its adaptability to the needs of lifelong education. The Faure Report and other influential sources have helped spread the message that most education is not formal, but based in community processes (Harbison 1967), peer and family influences (Coleman 1966), and workplace (Mincer 1962).† The BLS reports that 5 million Americans were enrolled in home-study courses in 1972 (U.S. BLS 1974, pp. 20-21).

Another reason that NFE addresses a broad spectrum of education issues is that it tends to pick up the slack of disenchantment with formal education on a wide front (Illich 1971; Simmons 1974). Attributed failures of formal education range from its inability to inculcate values (Greeley and Rossi 1966) to its bias against the poor (Pearl and Reissman 1965; Dore 1975; Bowles, Gintis, and Simmons 1976). NFE thus is seen by many as an attractive (albeit still unproven) alternative to these ends.

Finally, the all-embracing quality of NFE is fostered by an appreciation of the complexity of development efforts. Even starting from a narrow, economic, functional focus, changes in NFE-based skills/knowledge/attitudes lead to other changes and needs for adjustment. For example, skill training often yields benefits only when workers, employers, and the community as a whole learn how to use those skills (Harbison 1967, p. 22). Otherwise, the community is simply left with better-educated unemployables, or with out-migration of skilled people (Luytjes 1971; Edwards and Todaro 1972). As another example, NFE might start with the introduction of a new educational medium, say radio broadcasts to rural villages; but building on the potential of this medium requires the provision of other media--workbooks, processing of feedback from peasants on the relevance of broadcasts to local problems, newsletters, development of texts to clarify the meaning of individual programs within an overall development strategy, and so on. The history of ACPO (Accion Cultural Popular) in Colombia is a good illustration of this process (see Ahmed and Coombs 1975, Chap. 1).

One reason why NFE is so difficult to pin down is that if there were any well-validated and politically acceptable formulas for success, the strategy would tend to become part of formal education, like any other pilot project. Or, if NFE succeeded in solving particular problems, it would go out of business (or into a new one), unlike the tenacity of formal education to persist beyond its usefulness. In either case, NFE "dissolves" in the process of success. The state-of-the-art of NFE planning, therefore, is like a moving weather front, rather than a cumulative edifice of knowledge. One can specify "issues for further research," but the "core" features of NFE, as distinct from formal education, are few. They include the following:

* Principal sources for this section on NFE include documents from Michigan State University, Institute for International Studies, College of Education, which has received major support from AID to study NFE (esp. Axinn 1974; Hunter, Borus and Mannan 1974); and the work of the International Council for Educational Development (ICED) prepared for UNICEF and the World Bank (Coombs 1973; Coombs and Ahmed 1974; Ahmed and Coombs 1975).

† Mincer has calculated that more than half of the "human capital" component of the U. S. male labor force is formed on the job, and less than half in formal schooling.

The cost-saving feature of NFE is a less powerful argument than it once was. Some NFE supporters feel that the low-cost argument has been detrimental, given the expensiveness of certain NFE projects and the importance of other, more distinctive and compelling selling points. (Personal communications with staff of AID/Washington, Fall 1974.)

Good sources of NFE cost analysis include Hunter, Borus and Mannan (1974) and Coombs and Ahmed (1974). Coombs and Ahmed's case studies are presented in some depth but are also grouped according to general categories of NFE such as agricultural extension, cooperative self-help programs, and integrated rural development. Comparisons of costs and performance are then made within each of these groups. This helps to avoid the mixing of apples and oranges, and juxtaposes programs which have most to learn from each other. Cost-effectiveness comparisons are particularly revealing for certain pairs or groups of programs: PACCA in Afghanistan and Puebla in Mexico; ACPO in Colombia, Gezira in the Sudan, and the Comilla project in East Pakistan. In one comparison of six rural training programs, costs per trainee were found to vary between \$20 and \$3,200 (see page 196). In examining the difference, the more expensive program was found to have superior results on some counts but significantly poorer results on others. (This analysis reveals how misleading cost-effectiveness comparisons can be when limited to single indicators of performance.) The Coombs and Ahmed book is particularly useful (pp. 197ff) in synthesizing case study material to draw out strategies for reducing costs (e.g. collaboration with formal education institutions to reduce overhead).

Adaptiveness is probably the most widely cited virtue of NFE, and it refers to several things: flexibility to change over time, sensitivity to local needs and conditions, and capacity to exploit new media and subject materials. The key lies in working outside of established bureaucracies to avoid vested interests, conservative political pressures, and the pure inertia of large institutions. But the issue is complex. Often, adaptiveness is bought at the price of quality control. Successful NFE, at best, will grow and spread, and create its own institutional rigidities. NFE can be as complex as formal education, and perhaps more so, being in a less "self-contained" activity and more woven into other social processes.

It is often argued that NFE better serves the poor, based on several premises. It can focus more directly on the basic needs of poor communities. It puts less emphasis than formal education on formal prerequisites, screening, certifying, and social selection (Dore 1975; Pearl and Reissman 1965). NFE can be part-time and short-term, requiring less sacrifice of income foregone for poor students.

But there is another side of the story, too. NFE can become a "second-class" education for the poor, widening the gap of social opportunities between classes (Pearl and Reissman 1967). Alternatively, expensive NFE programs tend to be instituted as pilot projects in relatively well-to-do areas, without budgetary means to expand offerings to poorer clients (U.S. GAO 1974). As long as NFE does not directly confront the class biases and regressiveness of the formal system, its effects may be swamped by the social and economic forces acting to perpetuate inequity. In fact NFE may reinforce the deep structural foundations of social injustice by implying that "Something Is Being Done" (Gintis 1972).

This leads to more far-reaching issues: How explicitly can NFE raise ideological questions of development? Can significant structural change begin with the kind of social mobilization that NFE could promote among peripheral groups? These may be the most significant questions of all concerning NFE. Nevertheless, they lie beyond the scope of conventional definitions of educational planning.

CHAPTER 3: EDUCATIONAL PLANNING MODELS AND INDICATORS OF EFFECTIVENESS

MODELS

Broadly defined, a "model" consists of an abstracted representation of reality, depicting important relationships. In a planning context, it usually serves to show the relationship between policy objectives, policy variables, the effects of environmental factors mediating programmatic outcomes, and points in the system to be monitored for on-going system maintenance and development.

ALGORITHMS AND HEURISTICS

Models can be divided into two broad classes--algorithms and heuristic aids (see Fox 1972). Algorithms represent processes expressed in mathematical forms constructed in such a way as to yield clear "solutions." Examples are linear programming, benefit-cost and rate-of-return analysis, input-output analysis and other optimization techniques. In this context, Correa (1975) stipulates that a model should consist of four elements: endogenous variables; exogenous variables; a plausible set of cause-effect relationships linking the components of the model; and consistency, meaning that the model is neither under- nor over-determined.

Heuristic models, on the other hand, depict logical relations that help in exploration of possible solutions that are nevertheless beyond the capacity of mathematics to specify as "optimal." Examples are gaming and simulation, very long-range forecasting based on explicit judgmental components; sensitivity analysis; goals-achievement and cross-impact matrices; decision trees; block diagrams, and scenario building. In this sense the concept of a "model" may extend to consist of a specific experimental program, whose key elements are clearly spelled out, but which is open to judgmental interpretation and re-analysis on the basis of second thoughts about the dimensions of the problem and type of data brought to bear. Heuristic models may also include "theories for insight" (Davis 1971, pp. 6ff.). The following discussion refers primarily to algorithms rather than verbal or graphic heuristic models.

Davis (1971) lists major classes of educational planning models according to use: (1) target setting (social and demographic; manpower; rate of returns; growth residuals analysis); (2) allocation (mathematical programming, linear and otherwise); (3) input-output (production functions, regression analysis); (4) learning and teaching models; (5) organizational models (decision models, graphics, games, organizational behavior), and (6) comprehensive modelling (simultaneously addressing goal-setting, definition of program alternatives, and evaluation of options). Davis makes the point that the connection between one type of model and the next is very weak. They involve different types of expertise, different degrees of recognition of real world conditions, and different assumptions about the educational process. Especially serious is the discrepancy between theories of learning and models of the educational system, for example as expressed in regression analysis (Davis 1971, 1976; Leucke and McGinn 1975). There are other, more general problems encountered in planning models, to be reviewed at the end of this paper. Space does not permit commentary on all types of models referred to above, but the state of the art can be suggested by brief review of developments in five areas: (1) manpower planning, (2) educational production functions, (3) cost-effectiveness analysis, (4) heuristic modelling, and (5) systematic models of instructional development.

MANPOWER PLANNING MODELS

The basic character of manpower models has already been described. Nevertheless, a brief comment on the accuracy of manpower planning is appropriate here, in assessing the state of the art.

The Bureau of Labor Statistics has attempted to assess the accuracy of its own manpower projections,

in evaluating the ten-year forecasts from 1950 to 1960. Of 108 occupations, only nine were dead wrong; another 24 were substantially off but in the predicted direction (generally in the sense of under-estimating rates of growth in expanding sectors); the rest were basically correct. (U.S. BLS 1974, p. 3.) Strong criticisms have been raised against manpower planning elsewhere, particularly reflecting early-sixties applications under the Mediterranean Regional Project. Mark Blaug writes (1970, p. 169), "man-power requirements appraisal is simply an illegitimate extension of Leontief input-output models to periods so long that the assumption of fixed coefficients becomes an absurdity." He points out that a (reasonable) 2 percent error from year n to $n + 1$ will combine to a 35 percent error in 15 years. As Davis and Lewis note (1975, preface), unemployment rates can be doubled unexpectedly in a single year (as they did in the U. S. from 1973 to 1974), throwing off calculations of incremental needs for selected occupations by wide margins even for short-term planning. The BLS admits that it is very difficult to estimate either manpower supplies or training needs very accurately, given the high variability both in the functional content of job requirements and in the content of training programs. The problem lies both in poor data and real-world variations that cannot be statistically rationalized (U. S. BLS, *op. cit.*). Blaug sees the major flaw in manpower forecasting to be in the arbitrary nature of the mix between professional and sub-professional skills assumed necessary for sectoral activities (Blaug 1960, p. 165). Other problems, shared by other planning models and methodologies, are discussed later.

EDUCATIONAL PRODUCTION FUNCTIONS

The economic basis for allocating education resources requires some calculation of the relationship between inputs and outputs of educational systems. Resources are shifted to inputs which are most efficient (least cost) or effective (adequate for meeting targets), and shifted away from less productive activities. The definition of inputs and outputs will vary (see Table 1). A broad definition of production functions might include whole systems of equations, or possibly simulation models driven by sets of equations and inequations. These serve the same purpose as a single-equation production function, but disaggregate the transformation processes from inputs to outputs, and may allow more room for judgment, probabilistic relationships between variables, sensitivity analysis, and experimentation with the parameters of the model.

TABLE 1. TYPES OF EDUCATIONAL PRODUCTIONS FUNCTIONS

	Inputs	Outputs
<u>School Models</u>	(a) economic resources	(b) educational activities (for example, pupil-years of instruction, retention rates, curriculum reform, team teaching. See Durstine and Hudson 1972).
<u>Learning Models</u>	(c) educational activities	(d) instructional outcomes (usually cognitive ability, see Coleman, 1966).
<u>Economic Models</u>	(e) educational achievements (levels of training)	(f) economic outcomes (aggregate growth, sectoral targets, project goals).

It should also be noted that other types of educational planning models, such as linear programming, incorporate production functions in the form of technological relationships defining the objective function.

There is some overlap between estimation of production functions and "evaluative research" on educational programs. The difference is largely whether one uses sociological tools of analysis (see Helm and Perl 1974; Leucke and McGinn 1975; Averch *et al.*, 1972; Coleman 1966), or whether economic methods are used (see Bowles 1969; Correa 1975; Fox 1972; Zymelman 1973). In the economic approach, relationships are typically depicted by regression analysis, which specifies relationships in terms of multiple correlation, expressed in a single equation. Correlations are not always accurate as an expression of cause-effect relationships, and there is growing recognition of the disparity between the relationships depicted in

regression analysis and those which hold in the real world, based on educational theories and the experience of educational practitioners.

Another serious flaw is the use of aggregate data in calculating production function relationships. Individual schools, individual students, different races, regions of the country, urban-rural populations, groups with different motivations, differences in family and social environment--each of these differences will generate differences in the coefficients of a production function. Say there are eight such "environmental" variables, each of a binomial nature (an extreme over-simplification). There would theoretically be a 2^8 or 256 distinct production functions to calculate. (The Coleman report computed separate equations for white and non-white populations, and for different regions of the country, with marked differences showing up among these equations.)

For this reason among others, there is an understandable reluctance among educational policy makers to take production functions very literally. Very broad and persistent findings--for example, the importance of non-school factors in determining a large portion of academic achievement--find their way into public consciousness (the theme of "de-schooling society") and into educational policy (for example, renewed emphasis on traditional "3 R's" which constitute the schools' relative advantage; and more attention to non-formal education, with its lower overhead and greater flexibility for experimentation). These are important findings, but the value of production function analysis remains questionable: the coefficients hold only for highly disaggregated populations; they are prone to shift over time; and the coefficients are still a step or two short of specifying cause-effect relations.

Up to a point, regression analysis can be controlled to incorporate theory of educational processes (ordering the sequence of variables entered into the equation; use of non-linear and dummy variables; separate analysis of different population types; use of so-called "path analysis," which interprets regression coefficients in a more stringent context of theory-based relationships depicted in block-diagram format). Yet major problems remain. First, regression analysis typically uses cross-sectional data to simulate longitudinal process, and this can be seriously misleading (Campbell 1969; Leucke and McGinn 1975). Second, the refinements of regression analysis needed to make it conform to reality are beyond the training and patience of most educators and policy makers, and consequently few rely on it with confidence.

Third, and probably most important, policy implications of production functions, to the extent they are clearly significant and broadly applicable, are in most cases saying nothing new. For example, the importance of family background in determining school achievement is part of the age-old conventional wisdom of teachers. The question is, what would it take to overcome that pattern? The answer is not to be found in equations. Rather it must come from the "outlier" cases--the exception to the rule, the innovative programs which need to be studied as "intact" experiences, and not as a set of data points lost in the fringes of the aggregate educational "system."

In sum, production function estimates can confirm general insights regarding the relative effectiveness of different interventions into the school and its social environment; but the numerical coefficients of individual studies are likely to be unreliable as basis for resource allocation decisions, no matter what refinements are made in the technique.

Some of the problems of regression analysis can be avoided by basing the estimation of input-output relationships upon the analysis of specific policy options, entailing in-depth study of factors that make the options comparable or distinct. In effect, this means we are now talking about cost-effectiveness analysis, the next type of model to be considered.

COST-EFFECTIVENESS ANALYSIS

General issues of cost-effectiveness analysis have already been discussed. The question how to measure "effectiveness" will be taken up later in dealing with performance indicators. Here, the focus is on alternative analytical models for cost-effectiveness.

The first consideration is whether analysis is to focus on education purely as an economic investment. If so, "effectiveness" becomes translated into monetary terms, and the usual term for this kind of approach is cost-benefit analysis. There is no need for much elaboration here. Good expositions are available in the literature (Hardin and Boris 1971; Blaug 1967 and 1970; Somers and Woods 1969; Levin and Shank 1970; Kiker 1971; Mincer 1962; Hansen and Wisbrod 1970; Arrigazzi 1972).

"Cost-benefit" and "benefit-cost" are generally interchangeable terms. Either way, this kind of analysis can refer to a variety of formulas. One can calculate either a benefit-cost ratio, or net benefits. A similar but distinct calculation yields an internal rate of return, which can be compared with the going

interest rate (or "discount rate") to assess the relative merit of the project vis-a-vis other opportunities for investment. Another variation is to calculate the pay-back period. All these approaches share the same basic premise: that streams of costs and benefits can be compared by using appropriate rates of discount against amounts that accrue in the future years; all this assuming that intangible items (those which cannot be monetized) are negligible.

New developments in the field are of two types. On the one hand, refinements are made in the treatment of certain calculations that underlie cost-benefit ratios, for example in the choice of discount rates, the estimate of shadow prices, the application of sensitivity analysis for questionable parameters, the treatment of consumer surplus, determination of project life-time, and so on. A series of deliberate choices has to be made in selecting the parameters of any cost-benefit calculation, and these choices are sometimes best brought to light by an advocacy approach, with opponents and proponents of each project determining the outer boundaries of uncertainty, as explicit input to decision makers. In some respects, however, the state of the art has achieved definite progress, closing the gaps of disagreement, for example in developing rule-of-thumb conventions about the monetary equivalents of categories like time savings, accident prevention, lives saved, aesthetics preserved, crime deterred, unemployment avoided. (See, for example, the annual publication, Benefit-Cost and Policy Analysis; and Hill 1973).

The other type of development in the field of cost-benefit analysis is not aimed at refining traditional techniques, but at expanding the concept of cost-benefit to cost-effectiveness (which considers non-monetary outputs) and beyond. What lies "beyond" cost-effectiveness? Some see cost-effectiveness as an input-output component of a layer modelling format which sometimes goes by the name of systems analysis. (See especially Ryan 1964; Abt 1966; Coulson and Cogswell 1965.) For others, cost-effectiveness leads to multiple objectives, calling for judgment in weighing different goals against each other, and permitting more attention to the process of re-designing options to capture the best possible trade-offs among objectives (see Hudson, *et al.*, 1974). Finally, there is yet another variation of cost-effectiveness analysis which treats both multiple objectives and multiple publics, using a matrix format. This approach can either provide for numerical weights to be attached to the various objectives and publics considered (Morris Hill's Goals Achievement Matrix), or it can leave them unweighted, with more "circumstantial" information provided to the decision maker for him/her to arrive at an independent judgment (Nathaniel Lichfield's Planning Balance Sheet). (Hill 1973; Lichfield 1970.)

Perhaps the best test of cost-effectiveness analysis must come from cases where it has been carried out and improved (or at least affected) real decisions. Cost-benefit analysis has only rarely had a discernable apparent impact on educational policy. In some ways, this is understandable: the kind of goals that educators strive for are not well expressed in terms of monetary ratios. Economic efficiency is a poor rallying cry for people with the loftier views of educational roles in social progress that were current in the sixties.

Possibly, some of the disillusionment with education as a driving force in social growth and economic development since the sixties (see Illich 1971) could open the way for a harder look at the relative efficiency of educational policy options. As director of Chile's educational planning operations in the sixties, Ernesto Schiefelbein found wide disparities between the productivity of educational programs directed toward similar goals. Arrigazzi (1972) reviewed earlier benefit-cost studies of educational options in Chile, offering constructive criticism and improvement. These represent rare but instructive cases of systematic and cumulative improvements of methodology. Significantly, they refer to cost-benefit applications in a specific policy context.

Elsewhere, benefit-cost analysis has not fared as well. Its most ambitious application to date has not been in the field of education but in the famous debate over choice of site for London's third airport (see Flowerdew 1974). There, final recommendations were overturned because the benefit-cost method had failed to capture important intangibles (*i.e.*, non-quantifiable outcomes) at stake in the investment decision. The same problem is likely to be even more severe for education than for airport location decisions. In its pure form, benefit-cost analysis can help prevent grossly inefficient choices; but it cannot weigh marginally close alternatives with much credibility. Two questions remain unanswered after net benefits have been calculated: benefits for whom? and are economic benefits really what education seeks as beneficial?

In search of better answers to these questions, analysts have turned increasingly to formats and processes which give explicit attention to multiple publics on the one hand and multiple objectives on the other. (See above.) Benefit-cost analysis retains two advantages over these newer approaches, however. One is that it has more codified conventions, a longer history of application, and more rigorously defined procedures, so that its weaknesses and strengths are fairly well known, at least among trained professionals. Secondly, benefit-cost analysis makes some attempt to make present and future values commensurable by use of discount rates, which are ignored in most other approaches. The discount rate is itself a highly problematic variable, and one of the most sensitive parameters affecting benefit-cost calculations. The determination of appropriate discount rates for different educational projects is a vital area of research and debate. Principally it involves the ques-

tion of opportunity costs for educational resources, and this is why educational finance becomes an inseparable issue from benefit-cost analysis. Researchers at the University of California at Berkeley have investigated this issue of educational cost and finance, and their work has led them unavoidably into the issue of equity. Economists may still have little to say about valuing the non-monetary outcomes (and costs) of educational policies. But the economist can contribute a great deal by way of analysing the distribution of benefits and costs, however defined. If equity issues continue to grow in importance among planners, the "multiple-objectives, multiple-publics" matrix formats may come to take on a larger role in cost-effectiveness evaluation of educational programs. A major strength of these evaluation formats is their capacity to incorporate more conventional cost-benefit analysis as one "column" of the analytical matrix, showing the distribution of benefits and costs among a variety of producers and users of educational services.

In concluding this discussion, it is worth recalling a point made by Somers and Woods (1969, pp. v-vi) in regard to the implementation and political uses of cost-benefit analysis. The institutional, methodological and conceptual hurdles of applying any analytical device to political issues are formidable. The problems of PPBS are by now well documented (see, for example, Hoose, 1972), but PPBS addresses the same fundamental issues as cost-effectiveness analysis: it directly confronts the "business as usual" mentality of policy making with the hard data necessary to make objective appraisals of everyone's favorite programs. The problem of cost-effectiveness is probably not so much in its preparation, but in the fact that it is such a difficult pill to swallow.

HEURISTIC MODELLING

As already mentioned, heuristic models are not algorithms which yield optimal solutions within a standardized mathematical format: instead, they provide a search format for key elements and relationships in the formulation of complex problems. (An algorithm is a technique, mechanism, or rule structure which prescribes how to reach a fully specified goal. A heuristic, on the other hand, serves to discover, guide, and reveal goals which cannot be precisely specified because we know what they are but not where they are (see Dunn 1974, p. 37). Platt (1974, p. 5) sees educational planning tending to shift away from target-setting (which implies fixed goals and discontinuity between one plan and the next), toward a "vector" concept of planning (vectors describing a rate and direction of movement, but not stopping places). Banghart and Trull (1973) stress the importance of cybernetic principles in planning, in contrast to the "blueprint" model carried over from physical planning.

Cybernetics (the science of communication and control) provides a guidance process, a set of "procedures" and a "direction," and not simply a "plan." Simulation, scenario-building, network scheduling, management information systems, systems analysis, needs assessment—all draw heavily on the cybernetic, as opposed to the blueprint approach (Banghart and Trull 1973). Ernesto Schiefelbein (1976), writing from the vantage point of operational planning practices in Chile and other Latin American countries, observes a similar shift in planning emphasis, from pure techniques to behavioral models and planning heuristics (his own use of the term).

It might be argued that heuristics is just an "easy way out"—a way of dispensing with the rigor of more systematic, algorithmic models, and a way of avoiding political commitments to clearly specified targets. Given these pitfalls, heuristic modelling needs to be justified in the context of well-defined purposes. The approach is useful where basic disagreement exists on the facts, causal relations, or values involved in planning decisions, so that analysis must be opened up to a greater degree of "informed judgment" based on techniques like Delphi, simulation, and dialectical scanning (see Hudson, Davis, *et al.*, pp. 71ff). Heuristics are also useful for relaxing some of the problematic assumptions built into formal algorithms. They do not replace the assumptions, but help reveal what is "left out" from an understanding of planning problems as a consequence of rigid focus on mathematically defined relationships. Finally, heuristic approaches are especially useful in planning for long-range futures, which can easily be mis-represented by rigid models of projection from past trends: structural relationships change over time as social institutions evolve and adapt; inter-relationships are extremely complex; major events are disjointed, in contrast to the continuity of trends expressed in most mathematical models; and most important, the future is malleable—a function of social commitment, and not just the outcome of forces empirically measured in the present and past.

To be sure, a certain amount of long-range forecasting is carried out in educational planning with major reliance on algorithmic-type models. The U. S. Bureau of Labor Statistics periodically publishes decade-long projections of manpower needs (U. S. BLS 1974), and demographic analysis is routinely being carried out through the year 2000 (see Morrison 1976). Heuristic modelling comes in mainly for assessing the broader social, political, economic and technological trends shaped by historical processes beyond the present grasp of mathematical expression. The techniques for long-range scenario building have been evolving quite rapidly in recent years, becoming quite sophisticated and rigorous in terms of procedures (Educational Policy Research Center 1970; see also the special issue of Educational Planning 2:3, January 1976). Two chapters in the OECD book (1973) are representative. In one, Froomkin describes four "heuristics" of long

range planning, apart from the more traditional analysis of trend extrapolation: (a) "genius forecasting," (b) "scenario construction," (c) mathematical simulation, and (d) consensus planning (primarily Delphi). Another chapter in the OECD book is by Willis Harmon *et al.*, titled "The Forecasting of Alternative Future Histories, Methods, Results, and Educational Policy Implications." This work focuses on needs, values, and beliefs as the generators of alternative futures, referring to a half-dozen major "sectors"--U. S. economic performance; world population and subsistence; scientific and technological advance; politics and demography; and U. S. foreign relations.

One can argue with the results of such analysis, but typically the heuristic approach does not aim at a single prediction; it describes alternative futures, the forces moving society toward one or the other, and the points of intervention that are available to policy makers. In most of the recent work, education is not seen as a leading sector or point of intervention for controlling the future. Instead, education is seen in the role of responding to conditions generated by "larger" social economic and political forces. This represents a change, or in some sense a disillusionment, with the thinking of the sixties, which often depicted educational investment as a major force in economic growth and social change (see, for example, Denison 1962; Bowman *et al.*, 1966; Robinson and Valzey, eds. (1966) esp. Part II, "Education and Economic Progress," pp. 89-348).

This brings home, once again, a point made earlier, that educational planning is closely tied in with prevailing theories of socio-economic processes in the larger context of development. This does not mean that strong links have been forged between educational planning and national development plans, or between planning and research on educational effectiveness. But it does mean that new models underlying educational planning seem to evolve in a way that is fairly responsive to general shifts in the conventional wisdom about the role of education in economic growth and social change (see Cohen and Garet 1975). The seventies have learned at least something from the failures of the First Development Decade of the sixties; social goals are not fulfilled by economic processes alone; and economic growth does not follow mechanically from educational investments in the way depicted by writers a decade ago. Newer approaches to modelling, in addressing alternative futures, raise the issue of what it would take, especially on a political level, to bring about the more preferred scenarios. Econometric models and even probabilistic models tend to focus on something else--a depiction of relationships measured in the past and projected into the future. Heuristic modelling on the other hand, moves toward analysis of ways to break from the past. In part this reflects a sense of failure in past planning efforts, a realization that the old models were either invalid (Blaug 1970; Averch, *et al.*, 1972) or politically insensitive to the key problems of social development (Goulet 1971; Hallak 1974; Faber and Seers 1972; Caiden and Wildavsky 1974) or even counter-productive (Dag Hammarskjöld Foundation 1974; Doeringer and Piore 1971; Edwards and Todaro 1972; Luytjes 1971; Illich 1971; Schumacher 1973; Simmons 1974). On the other hand, the heuristic approach also seems to have gained ground by the emergence of isolated models of success among educational systems addressed to basic problems, such as provisions for basic needs among poor people. In this sense, a major contribution to the heuristic tradition seems to be from the sector of non-formal education.

SYSTEMATIC INSTRUCTIONAL DESIGN

The past decade and a half in education has been marked by the emergence of what is known as "instructional development," or "systematic instructional design." This phenomenon is both a movement and an increasingly respectable sub-discipline of education--and educational planning. As developed and expounded by leaders in the field, instructional design brings principles from systems analysis together with learning theory (usually behaviorist), to form a set of principles for planning instruction (Gagne and Briggs 1974; Davis, Alexander and Yelon 1974). It is a particular kind of heuristic modelling.

The basic ideas are simple, and therefore relatively powerful. If educational outcomes can be stated in behavioral, hence measurable terms, then instructional activities can be designed, tested in relatively rigorous terms against these outcomes, and modified until they are successful in goal accomplishment. Learning activities are designed with explicit use of learning theory. There is great emphasis on formative evaluation.

Instructional design has come to closely associate with yet another, somewhat older movement--instructional (or educational) technology. This technology, which is closely associated with the field of communication, is essentially a technology of hardware; whereas instructional design is essentially a technology of ideas. Increasingly, however, the two models tend to be found together, as in planning for instructional television.

Planning models of this type have most typically been used at local levels, often within specific schools or even classrooms. However, we are now seeing their application at national levels for large-scale educational reform efforts, particularly those involving instructional media. In Korea, for example, the Korean

Educational Development Institute is in the middle of a five-year pilot test of an entirely new instructional system emphasizing use of a variety of technologies (radio, television, audio-visual aids, self-instruction). The entire system is built on explicit use of instructional design models. If successful, the system will be installed nationwide (Morgan and Chadwick 1971).

Instructional design models are heuristics, essentially describing a set of procedures to be followed in the empirical development and testing of learning activities, materials and systems. Cost considerations are increasingly important, particularly as many proponents of this planning approach use increased efficiency as a major argument for their reforms.

As heuristics, these models do not offer immediate hope for strengthening a generally weak aspect of algorithmic models for educational systems planning--the definition of the relationship between different levels and patterns of use of educational resources on the one hand, and educational accomplishment (cognitive or otherwise) on the other. The models are prescriptive and normative, not predictive. They tell the instructional planner how to go about his task; they cannot yet be expressed as equations which predict a certain level of achievement, give assumptions about resource inputs, for a large system.

These models, which are affecting the quality and structures of education at all levels in the developed countries, are increasingly found in less developed countries as well. As educational planning becomes increasingly disaggregated, they are becoming more important tools for planners.

INDICATORS OF EFFECTIVENESS

There exist compendia of educational system performance indicators (for example, Carr-Hill and Magnussen 1973). The state-of-the-art is best seen, however, from the broader perspective of the "social indicators" movement, which emerged in the policy sciences during the seventies. It reflects several concerns: first, the need for better specification of objectives required by rational planning techniques such as PPBS, system analysis, cost-effectiveness analysis, logical framework specification, MBO (management by objectives), as well as traditional preparation of Master Plans at regional and municipal levels. Second, social indicators have grown out of the need for better evaluation of social programs, particularly with the proliferation of social legislation in the U. S. under the Kennedy, Johnson, and Nixon administrations. Third, social indicators serve to monitor side effects of major public or private investments. Environmental Impact Reports, now commonplace, provided the lead for Social Impact Reporting now under discussion (Grigsby and Glickfield 1976). Fourth, they reflect a concern for political accountability in the post-Vietnam/Watergate era. Along these lines, there has been a growth of Advocacy Planning; a greater involvement of the U. S. Congress in reviewing the Executive Branch (through the General Accounting Office); the establishment of national citizen's groups like Common Cause and Public Interest Research Groups; and greater involvement of academic institutions in policy research. A dramatic example of the U. S. strength in this type of work was the divergent fate of the French-British Concorde and the American SST. Europeans attribute the difference largely to the availability of social data on SST impacts. (Key data collected in Europe were held as confidential by those governments.)

The relevance of all this for education is two-fold. First, there is growing concern for educational relevance to social objectives beyond school efficiency, or traditional economic goals of manpower planning and higher average incomes. Second, there is greater appreciation of the overwhelming impact of social processes on schooling outcomes (see the Coleman Report, 1966; Averch, et al., 1972).

Indicators of educational effectiveness fall into three general classes, depending on the "production function" one has in mind (see earlier discussion of production functions).

SCHOOL-BASED INDICATORS

These indicators are usually measurable within the educational system itself, and reflect its internal efficiency. These may include measurement of unit costs per graduate or per pupil-hour of instruction; cognitive gain and costs per gain-unit; classroom hours of instruction; growth of enrollment, retention and promotion rates; drop out and "force-out" rates; ratios of enrollments to relevant population age groups; instructional inputs per pupil (teachers, textbooks, equipment, classrooms); instructional technology utilization; proportion of private and public funds spent on education; vandalism of school property (an index of alienation from educational processes).

ECONOMIC OUTPUT INDICATORS

These generally refer to the effects of education on human capital formation. Measures include: numbers of graduates by level; graduates by occupation; follow-up studies of graduates actually working in

their field of training; incomes of graduates; regional location of graduates; unemployment among graduates; unemployment in society at large; on-the-job training accompanied by subsequent employment.

SOCIAL PROCESS INDICATORS

These include economic outputs, but with more specific reference to social objectives, including small business starts; social projects undertaken; cooperative societies established; local participation in educational planning; geographic stability of graduates; voluntary contributions of local community to school activities; equal educational opportunities among sexes, regions, income classes, castes, races, ethnic groups, religions, and (some would argue) intelligence levels; self-reliance of local communities; "sense of efficacy" among graduates (for example, as measured in the Coleman Report, 1966); fulfillment of "basic needs" like food, shelter, health; development of careers and life-styles blending intellectual and manual labor; reinvestment of economic surpluses within local communities; organization of self-help services for the poor.

There are other ways to categorize indicators. For example, one can refer to "input" indicators, depending on which part of the production function one is interested in. One can also distinguish "product" indicators from "process" indicators, where processes (e.g. term teaching) are more easily observed than final outcomes, and are held to be beneficial based on theory or past experience.

It also is useful to differentiate between "outputs" (intended, directly controlled results) and "outcomes" (usually unintended, resulting from the interaction between outputs and the social environment). Outputs and outcomes are sometimes referred to as primary and secondary consequences respectively. One can further speak of tertiary consequences as the structural changes in the environment itself, in regard to values, institutions, distribution of power, and other permanent outcomes. (The line between primary, secondary and tertiary is fuzzy but useful: much of the fundamental criticism of schooling in current literature is addressed to "tertiary" issues as seen in the writings of Illich 1971; Katz 1971; Faure 1972; Simmons 1974; Gintis 1972; Hallak 1974). In contrast, "mainstream" educational literature usually refers to "primary" consequences, such as cognitive gain, achievement scores on standardized tests, and so on. Those who focus on "secondary" effects of education are generally concerned with particular communities, with education seen as only one part of a larger set of social processes (see for example, Luytjes 1971; Freire 1970; Pitts 1975; Raper 1970; Anderson 1973; Bugnicourt 1972; Coombs and Ahmed 1974).

Most textbooks on cost-effectiveness analysis, PPBS, systems analysis, management information systems (MIS), evaluation research and related fields have at least one chapter devoted to "measurement of objectives," or "performance criteria." A representative survey (see Denison and Rosenstock 1972, pp. 171-180) suggests five bases for evaluation of program objectives:

- appropriateness (is the indicator a valid measure of the ultimate goal being sought?)
- effectiveness (how closely can the program attain a specified target?)
- adequacy (how significant is the target vis-a-vis the total scope of the problem?)
- efficiency (how cost-effective is the program, in terms of attainment per unit of resources spent?)
- side effects (positive or negative, how are these to be weighted alongside "primary" outputs and costs?)

There is considerable discussion on the relationship between equity and efficiency as criteria for program evaluation: are the two goals basically in conflict? Are they compatible under specific conditions? Should they be considered under a single weighting scheme ("distributional efficiency" being subsumed under a larger concept of "grand efficiency"); or do they refer to entirely different forms of logic, involving a concept of economics vs. a concept of social justice? Weisbrod (1970) points out that distributional aspects of social programs are rarely monitored in practice (for an exception, see Hansen and Weisbrod, 1969). Weisbrod's own criteria (1970) for measuring distributional outcomes are quite different from Denison and Rosenstock's list mentioned earlier, suggesting that equity and efficiency indicators might be fundamentally different in nature.

In one respect, at least, equity issues represent one of the most promising applications of performance indicators. The relationship between educational inputs and outputs, the validity of measures, and the value of benefits are likely to be argued over for a long time to come, but the question of who gets how much can be settled fairly quickly and objectively.

The social indicators movement, for all its faults, raises important questions about the epistemology of policy sciences and the nature of social processes, apart from the effectiveness of particular programs. It should continue to serve education well in all these regards. A few problems concerning performance

indicators should also be mentioned briefly, however.

QUALITATIVE VS. QUANTITATIVE OBJECTIVES

Some quantitative measures serve as proxies for educational quality: retention rates, rates of vandalism, teacher credentials, income of student's parents (which correlates with the motivation of students and teachers), rate of programmatic innovation, rate of teacher turnover, expenditures per student, and richness of supporting inputs such as ETV and library facilities. On the other hand, the substantive goals of education are not well described by the educational processes themselves, and promotion of the school system's internal efficiency may be counter-productive to the broader functions of formal learning in society. Certain educational programs, for example, might bring about significant intangible costs--implicit rejection of rural life styles; the fostering of a consumption ethic that outstrips national production capacities; or the diversion of national resources away from appropriate labor-intensive technologies. As Schumacher points out (1972), a plastic chair that we might design eminently well for the function of sitting down may be horribly "inefficient" from the standpoint of Buddhist economics: for Buddhists, the function of a chair cannot exclude the aesthetic of its carving, whereas plastic--far from being "cheap" as its market implies--draws on non-renewable resources and cannot be recycled back to nature, both violations of a chair's "natural" function.

REPORTING FORMATS

Data are only as good as the context which transmits their message. More often than not, crucial information is lost among trivialities and lacking in accompanying prose to illuminate its significance, accuracy or source. Base line data is a frequent omission, especially in regard to base line trajectories: simple before/after comparisons are often misleading, since "improvements" in this interval may actually represent a decline from an earlier, higher rate of improvement. Third factors (besides program inputs) which may have affected outputs are generally unstated. The "logical framework" reporting format used by the U. S. Agency for International Development for many of its education programs addresses some of these problems.

Another problem of reporting is the tendency to undertake expensive studies or establish elaborate data monitoring procedures without prior understanding of who will use the data, or of which data will best serve actors and decision makers. All-purpose data-gathering serves no one in particular and no one well. A better focus on critical problems can often be achieved by a journalistic style of reporting, as a complement to more formal evaluative review and analysis. Journalistic investigation has been used extensively by the Peace Corps for internal evaluation.

INNOVATION

Programs aimed at creative experiment (or at social evolution in a broad sense, as discussed by Dunn, 1971) may shift their objectives over the life of a program. A major goal of education closely tied to social development might in fact be a clarification and shift of purposes. In contrast, a program rigidly adhering to fixed objectives might prove reactionary and inadaptive to the kind of turbulence that characterizes significant social change.

EMBODIED KNOWLEDGE

Some goals of education cannot be disembodied from specific social contexts, but make sense only in concrete settings. Take the five basic goals of education proposed by Stephen Bailey (1969, pp. 7-8): one is "contact with a variety of people"; another, "exposure to a variety of domains of work and pleasure"; another, "knowledge of consequences of both ecological and human relationships." * These make sense, but they can only be assessed in terms of performance indicators through a process of exploration adapted to local conditions.

POLITICALLY UNACCEPTABLE INDICATORS

It has become fashionable to speak of "outreach to poor majorities," and one can devise indicators to measure the degree to which efforts are actually directed to people who have been poorly served in the past. But obviously it takes more than better monitoring to change the behavior of the "haves" toward "have nots"; and without such changes, better monitoring is only an embarrassment. One can measure where new schools are built--in districts that already have them, or in politically disenfranchised areas that haven't. One can record how much time technical assistance advisors spend outside the capital city region of poor countries. One can measure the immediate income gains among (relatively well off) suppliers of education vs. the future (and heavily discounted) gains among students. One can measure the net benefits of education to small and poor communities vs. the benefits to richer regions which skim off the most productive graduates. Yet indicators are only welcomed by people willing to act on them; and those willing to act usually don't need indicators to tell

* The other two are more traditional and amenable to performance indicators: mastery of basic language tools (words and numbers); and mastery or appreciation of manipulative skills.

them what needs to be done. There are exceptions, of course. John Kennedy was reported to have been deeply affected by the careful documentation of poverty in Michael Harrington's The Other America (1962) (Schlesinger 1965). Even here, however, the significance of the documentation was not so much in the raw data as in the way they were presented, and in the political inclinations of an audience powerful enough to act on them.

Given these (and other) problems of indicators, it is well to conclude with a brief summary of their virtues:

indicators can be turned into graphs which are useful for summarizing large amounts of information, either cross-sectionally or in terms of time trends;

they help to focus debate on specifics: are these the right objectives? the right way to measure them? the right data? the right comparisons? the right moment to act on findings?

disagreement about the usefulness of indicators does not necessarily indicate a flaw in the data so much as a "litmus test" of the tacit assumptions, beliefs, and world view of the commentator. This is useful in itself, because tacit knowledge of this sort probably plays a significant role in planning and policy decisions, but rarely becomes an explicit focus of debate. Debate-free indicators are to be found either where they refer to a fairly meaningless level of generality (larger budget allocations, more advanced staff training, higher "quality" teaching, "better" management), or else where a situation is so well defined that one is operating in a "surprise-free" environment--for example, college entrance examinations in the context of a well-established tradition of higher education.

CHAPTER 4: EDUCATION PLANNING STRATEGIES AND SUMMARY OBSERVATIONS

PLANNING PROCESSES AND STRATEGIES: TURNING KNOWLEDGE INTO ACTION

There are various "meta-criteria" one can apply to planning theory, that is, criteria for assessing the scope, character and adequacy of various planning theories. One feature shared by most planning theories is a concern with strategies to link organized knowledge to organized social action (Friedmann and Hudson 1974). This basic idea of linking knowledge to action underlies the present discussion of planning processes and strategies.*

INSTITUTIONAL PLANNING CAPACITY

One way of approaching this review would be to survey present educational planning practices, particularly with reference to institutions that translate planning knowledge into planned action. A special issue of the journal Educational Planning (2:4, January 1976) presents an example of this approach. Farrell (1974) has carried out a comparative review of educational planning infrastructure and constructed a Guttman scale of institutional capacity. For example, he finds that most countries have an educational "plan"; fewer have good statistical services to keep the plan current or integrated with other sectors; fewer still link planning with budget-process implementation à la PPBS. Farrell's work is useful because it suggests a logical sequence for building up planning capacity, that is sensitive to a country's own history and resources to mount such an effort.

SOCIAL PROCESSES IN PLANNING

Extending Farrell's idea, there may be a sequence in the kind of social processes that planners come to acknowledge as part of the "educational planning problem." These processes, in turn, require development of strategies for the growth and development of planning systems.

Initially, the problem can be defined as a problem of economic growth: how to train the right categories and numbers of people to sustain industrial development (viz manpower planning, as developed in the sixties). Subsequently, however, this raises new issues of developing an administrative infrastructure suitable to modernization of the educational system. It is not just a matter of linear expansion of existing programs, but educational reforms, establishment of new institutions for curriculum renovation, media development, and above all, enrichment of managerial capacity.

Given all this new capacity to implement new ideas, planners begin to ask themselves--why don't plans usually work? Or when they work, why do they produce the wrong outcomes? Implementation becomes a major strategy concern. Planners find themselves forced to deal with the social context that affects educational policies: the way it affects policy implementation; the way it affects policy formulation and decisions; the way it sets priorities (e.g. equity vs. efficiency, modern sector development vs. saving traditional productive capacities; rural vs. urban investments). As Watson suggests (1974), real decisions and actions are rarely based on the kind of models educational planners use. The reason is, the models refer to a simple objective

* Other meta-criteria for judging the adequacy of a planning theory might include: explicitness about theories of social change; concern for problems of social learning as well as social action; inclusion of normative issues, such as social justice; tendency to promote self-control by individuals of their own lives; explicit identification of issues neglected by the theory; provision for participation in planning; adaptiveness to a range of social conditions; self-reflexive (or self-critical) nature of the epistemology underlying the theory.

There is a potential contradiction here: how can one plan to liberate others' initiative? Can one help others be self-reliant? Can one tell others "how to do it" without undermining their capacity to understand for themselves? It is not clear that these contradictions are actually capable of resolution at all; but it is clear that educational planners are beginning to grapple with the issue (see Hudson, Davis, *et al.*, 1976).*

Structural Reform

It is hard to argue against the proposition that education should be linked more closely with organized social action, particularly in a development context where there are obvious unmet basic needs. But once educational planners begin to consider the social context embracing school processes, many take the next logical step and ask, "Is it enough to mobilize people for sporadic campaigns and then leave them--better educated and rid of a particular problem, but with nothing else gained?" Or will social processes and institutions continue to re-create those problems, unless the structures themselves are changed?

Structural theories of social processes affecting education have already been mentioned. The bottom line of this approach is the need for basic change in the structure of employment opportunities, both in terms of re-organizing the work place and in the overall guidance of economic policy at local, national, and international levels. The major theoretical work on social structural reform as a context for significant educational planning has been couched in radical criticism of capitalist structures (see especially bibliographical material compiled by the Union of Radical Political Economists). In some cases, the relationships between educational planning and social structural reform are revealed by national major commitments toward structural change and subsequent attempts to work out educational implications. The context is often a decisive turning toward realization of socialist or cooperativist principles (Tanzania's Declaration of Arusha; post-revolutionary Cuba; China during the Cultural Revolution; Guyana's turn to cooperativist principles). Educational change in these cases often has characteristic features. It carries politics into the classroom, making ideology an explicit aspect of the socialization which all schools provide. As in the cases mentioned (among others), there is considerable stress on community self-reliance as a substantive focus of educational training. Finally, educational change is treated as experimentation on a mass scale, neither limited to the cautious innovation of pilot projects, nor imposed with finality. Typically, there is extensive evaluation and political debate, sometimes with encouragement for local variations and initiative-taking in new directions.

KNOWLEDGE INTO ACTION: STRATEGIES FOR PLANNING SYSTEMS

This brings up a final series of "knowledge to action" strategies bearing on educational planning: How does a system "learn," whether a school system, or social system or society of professional planners? What constitutes memory of past mistakes and successes to build on elsewhere? How do you evaluate experience derived from widely varying circumstances and adapt this to new settings?

Cybernetics

Briefly, three kinds of "learning" models can be found in the literature, that bear on educational planning. First there is the cybernetic (control and communications) approach, the familiar "feedback loop" in systems analysis block diagrams. ("Compare actual outcomes against targeted objectives, and make necessary adjustments of inputs.") On a more general level, the approach calls attention to the iterative nature of rational planning, and the need to re-consider goals, identify new alternatives for action, new means for implementation, new data on problem formulation.

The limits of this approach to "learning" reflect the limits of the "rationalist" planning tradition discussed in a variety of literature. (Friedmann 1973; Friedmann and Hudson 1974; Allison 1971; Caiden and Wildavsky 1974; Faber and Seers 1972; Goulet 1971; Hampden-Turner 1975; Hoos 1972; Illich 1971; Schumacher 1973; Simmons 1974; Watson 1974). Criticisms include ideological ones (rationalist planning preserves the status quo); pragmatic considerations (not enough attention is paid to the realities of organizational and human behavior to specify appropriate action); epistemological criticisms (rationalist models ask the wrong questions about the quality of human experience and program outcomes that cannot be quantified specified a priori); and operational issues (significant social action requires a commitment to stronger ideals than insipid abstractions like GNP and other numerical targets). In short, "learning" that will serve "doing" requires more than "feed-

* The Chinese have given explicit recognition to this dilemma in formulating "the mass line" in policy directives. The mass line is supposed to build on the wisdom, incentive, and practical experience of peasants and workers based in autonomous organizations, yet it also seeks to diffuse experience from one locale to another, to set political guidelines, and use resources efficiently. It aims at mobilizing people for change, but without disregarding differences in peoples' readiness for change. The balance between talking and listening, pushing and bending, mobilizing and sustaining local initiative is recognized to be a matter of constant struggle and debate. There are no "formulas" of the kind educational planners in the west like to rely upon.

function, which makes sense only if one considers education a simple and closed system. In reality, education is neither simple (it is a complex social system in itself) nor closed.

There follows renewed attention to planning models that can handle complexity, particularly in data management. Decision-free techniques, network scheduling, and management information systems allow the analyst to work closer with people "on the line." More data can be handled; probabilities and contingencies can be planned for; new factors plugged into the information-handling process (Davis 1971, pp. 42-54). Heuristic modelling takes its place alongside the more rigid algorithms of traditional planning practice.

FACTORS OUTSIDE EDUCATIONAL PROCESSES

Politics

But even with all this, educational planning processes cannot embrace significant factors bearing on the educational processes themselves. One significant factor is politics. Hallak (1974) argues that most educational planning models tend to treat educational problems purely in terms of technological relationships. But the problems are mainly political ones: especially in regard to the question of value trade-offs within education, and the question of whom the school system serves in society at large. His point is--there are no technical answers to political questions (see also Dickson 1975; Allison 1971).

Benveniste (1972) treats the same issue on a somewhat different level, referring less to politics at large and more to the "politics of expertise" and the particular distortions introduced by technocratic attitudes toward social problems and educational processes (see also Goulet 1971).

On a more descriptive level, there has been a growing amount of literature on the politics of educational planning reflecting particular country experiences (see the special issue of Educational Planning, January 1975). Davis and Lewis (1975) devote the final chapter of their book to a useful review of recent U. S. legislation bearing on employment, jobs, and training. Legislative intent is evidently another important facet of the politics of educational planning.

Quasi-Market Factors

Politics are not the only factor mediating educational planning outcomes in the larger social context. There are a host of social institutions which serve to create balances or imbalances in the supply and demand of school-provided skills: economic cycles, labor market segmentation, rates of entry and exit from the labor force, flexibility in hiring practices, technology developments affecting skill requirements, on-the-job training, military supply and demand for skills, and so on. These might be called quasi-market factors, in the sense that they refer to all the supply and demand adjustments which operate outside (a) the normal flows of graduates from rural schooling and (b) adjustments in those flows designed by traditional manpower planning. (A more detailed review of quasi-market factors is found in Chapter 2 of this paper.)

Social Mobilization

This is yet another factor which lies outside the traditional scope of planning for educational systems, yet it addresses the same issue of harnessing "underutilized" human resources to social and economic objectives. Kulp (1975) has written about the "campaign" approach to development (health programs, literacy campaigns, public works projects) and about the advantages of mobilizing people simultaneously for the purposes of education and social action (see also Breeden 1970; Barbadette et al., n.d.). Paulo Freire's approach is similar in stressing the need to build education around consciousness-raising and "cultural action" (1970). Good examples of building an educational system around problem-solving include the Colombian organization, Accion Cultural Popular (ACPO), and Ahmednagar College in India (see Hudson, Davis et al., pp. 61-70; also pp. 53ff for other cases).

In a sense the campaign approach runs parallel to the American pragmatist philosophy of education: people learn best when they know firsthand the significance of applying that knowledge. The "social mobilization" context for education planning is also consistent with theories of development going back to Joseph Schumpeter: in this view, the key is not resource availability (whether natural resources, capital, human resources or knowledge), but rather entrepreneurship. The French observer, Servan-Schreiber, strikes a similar chord in his assessment of the United States' comparative advantage vis-a-vis other nations. The American secret, he concludes, consists of breaking out of institutional rigidities in order to make things happen. It calls for a "revolution in our methods of organizing . . . the key to everything else . . . what counts is the determination to liberate initiative and show confidence in man at every level" (The American Challenge, 1968, pp. 262, 266, emphasis in the original).

back," just as "education" must be more than a well designed program of stimulus-response.

Knowledge Networks

A second approach to "systems learning" draws on a quite different literature of educational planning. One term for it is knowledge networks (Hudson, Davis et al., 1976; PADCO 1975; Leavitt 1975), and it emphasizes a case study approach toward building up a repertoire of successful strategies for significant educational change. Networks can be formal or informal. Formal networks tend to emphasize storage and retrieval of information, either in the form of documents or raw data. Examples are ERIC (Educational Resources Information Center), Systems Development Service, The Inter-University Consortium for Political Research, The Bureau of Labor Statistics, and the International Demography Data Directory. Informal networks, on the other hand, are built on personal relationships, derived from old school ties, joint work on international technical assistance teams, professional associations, and other shared experience. Unlike formal information storage/retrieval systems, personal networks bring people together who tend to share similar values, outlooks, and professional styles, and not just to examine "objective" data on a particular problem area.

Creative Learning

Finally, there is "creative learning," although what is meant here defies precise definition. It has three aspects which go beyond both cybernetic adjustment and the accumulation of wisdom through knowledge networks. Creative learning requires a specific type of consciousness about the nature of social change and development. To operate at this level of consciousness, the planner must be willing and able to analyze the growth and development assumptions which underlie the system of intervention. There are a range of possibilities, from scale growth and allometric growth through to programmed learning and creative learning (see Dunn 1971, pp. 8-30). Creative learning systems are non-deterministic and adaptive, and require "higher" levels of information processing (Dunn 1974, pp. 36-38).^{*} A similar point is elaborated in Vicker's work (1970) on appreciative systems. (For further elaboration of Dunn's concept see Schroeder, Driver, and Streufert 1967, and Anderson 1975). Anderson defines intelligence as the capacity of a system for modifying its own knowledge; learning as the capacity to fix a temporary pattern of internal states; and thinking as the generation of a temporary pattern of internal states. He then specifies three levels of adaptive systems: the first is knowledge but no intelligence, with changes in knowledge coming externally, as in a library system. This is adequate in a world with little change. Second are systems that know and learn: for this memory is necessary. This applies to lower animals such as jellyfish and sea anemones. Third are systems which know, learn and think. By organizing experience it is possible for a system to see beyond experience and anticipate a future unlike the past.

The key to a creative learning system, then, is the capacity to take departures from the past. The issue is not innovation for the sake of innovation, but the diffusion of capacity for thinking that leads to appropriate action on problems of significant concern.

The second facet of creative learning that again distinguishes it from cybernetic adjustment and accumulation of memory, is capacity to act and to use social practice as a means for social learning. This is a complex issue. On one level it connotes "action research" of the type Campbell discusses in his widely read paper, "Reforms as Experiments" (1969). On another level it calls for a particular quality in the personality of educational planners--a capacity and willingness to work directly in social action programs, getting their hands dirty in the field and becoming knowledgeable about social realities through the process of trying to change them.

Finally, creative learning through social action calls for epistemological foundations different from those of orthodox social science (see Goulet 1974, pp. 161ff; Freire 1970; Gordon 1972; Hampden-Turner 1975; Pitts 1975; Lawrence and Lorsch 1967, pp. 11, 160ff; Raper 1970, forward; Schumacher 1973).

This is not the place to discuss the "creative learning" approach, or weigh its merits and validity. It clearly occupies a niche among other theories of the "knowledge to action" processes in educational planning. The overall relation between these knowledge/action strategies, the planning issues discussed in chapter two, and the planning models reviewed in chapter three, will be considered below.

^{*} Levels of information processing are determined by the rule structures of the central processor, consistent with its perception of the environment. For example, a binary rule structure reads binary signals from the environment.

Table 2 summarizes the major issues, planning models, processes, and strategies considered earlier.

ISSUES	MODELS	SOCIAL PROCESSES	STRATEGIES FOR PLANNING SYSTEMS
1. Social demand	1. Manpower	1. Growth	1. Cybernetics
2. Manpower planning	2. Production function	2. Infrastructure	2. Knowledge networks
3. Cost-effectiveness	3. Cost-effectiveness	3. Implementation	3. Creative learning
4. Integrated planning	4. Heuristic modelling	4. Data management	
5. Localization	5. Instructional design	5. Politics	
6. Lifelong education		6. Quasi-market	
7. Equity		7. Social mobilization	
8. Work-relatedness		8. Structural reform	
9. Development context			
10. Non-formal education			

TABLE 2: ISSUES, MODELS, PROCESSES AND STRATEGIES OF EDUCATIONAL PLANNING

An obvious question arises: is there any meaningful relationship between these lists? There are several possibilities. First, each list shows a progression from traditional approaches to newer ones, and there is a rough correspondence among the four lists. Educational planning is seen to be evolving from its earlier concerns with manpower planning issues, models, processes, and strategies, and moving toward finer-grained cost-effectiveness analysis. Further down each list, there is a departure from an exclusively economic perspective, and greater concern with the political dimensions of planning. The subsequent stages are less clearly defined, but seem to involve greater consideration for educational processes outside formal school systems, and greater concern for experimentation, evaluation and learning about the conditions of educational success and failure. The exuberance of the sixties has retreated before the sobering failures of the First Development Decade. Mistakes were made, and structures and attitudes have been established that may stand in the way of future steps toward preservation of viable rural communities, a closing of gaps between rich and poor, respect for the environment, and preservations of traditional ways of meeting basic needs through self-reliance and local initiative. In short, educational planning has shifted from a "growth paradigm" to a "learning paradigm."

An alternative interpretation of the table might posit a stronger and more permanent role for the earlier entries in the list. In this view, each issue and each model would have fruitful application to a range of planning strategies. For example, the issue of manpower planning could be examined by an array of models (including cost-effectiveness analysis and heuristics), and treated through a variety of strategies, which explicitly address important social processes. Thus, manpower issues handled by a strategy of "creative learning" might result in widespread use of para-professionals; a strategy of "structural reform" could handle manpower shortages by a major shift in production technology, altering jobs to fit skills rather than vice-versa.

Still another view might interpret the issues, models, social processes and strategies of educational planning to be in continual flux, analogous to the "random walk" theory of the stock market. Stocks in one or another planning approach rise and fall, for reasons of current fashion, peer pressures, and the whims of funding agencies. Over the long run, it becomes clear that each approach is insufficient by itself. Work in one area produces diminishing returns, resulting in the discovery (or more usually the rediscovery) of other approaches needed to fill the neglected gaps. For example, the history of international assistance manifests a long cycle starting with the 19th century missionaries, followed by post-World War II technical transfer, then "institution-building," and more recently "networking." Presently, planners are beginning to come full circle, rediscovering the missionaries' virtues of dedication to the needs of the poor majority, and close-up insight to the problems and opportunities for tangible achievement (Hudson, Davis, *et al.*, 1976, pp. 11-15).

There is probably a certain basis of truth in each of these ways of interpreting the relationships and

trends among the issues, models, and strategies outlined in the table. If some master planner could knit these elements together into an overall model or strategy or plan, the items listed in the table might fall nicely into place. Educational planning as currently practiced, however, is based on social sciences procedures which are inherently reductionist and formalistic about the nature of the learning processes they attempt to deal with. It is therefore rare that planners achieve a total picture of the problems of shaping education to a country's needs. Cases of "successful" educational strategies serving major development objectives, or even meeting the minimal needs of the poor, are unusual. Where it "comes together" in this way is rarely on the drawing board of the planner. To be sure, there are exceptions like the Land-Grant College movement, but even this took fifty years of setbacks, maturation, and learning from farmers before emerging in its now familiar form (see Hudson 1976). Given the complexity, the long gestation, and the multiple theories of education and development, it is almost a wonder that success can be rationally "planned" at all.

Yet even this pessimistic appraisal leaves a vital role for the planner, and that is the identification and diffusion of those rare cases of success, often the product of indigenous efforts, where educational programs have been nurtured under particularly favorable conditions of political or ideological commitment, and where education addresses the problems people deal with in their everyday lives.

Not that this would yield formulas of success directly transferable to other peoples and regions. It would simply pose more clearly the question of what would it take for educational planning to achieve significant results. The answer should be clear: it takes more than education alone. It takes ideological commitment, social mobilization, an economic system driven by the interests of specific communities rather than the transcending goal of a higher GNP, and a richness of two-way communication between planners and the people they serve.

CHAPTER 5: LESSONS FOR COMMUNICATION PLANNING

What can communication planners learn from the research and experience of their cousins in education? More specifically, are there issues in educational planning which point to similar concerns as communication planning develops? Are there models and performance indicators which can be adapted for one or more areas of communication planning? Are there lessons for processes and strategies of communication planning? These last three questions are addressed below under the headings of issues, models and indicators, and processes.

ISSUES

In our review of educational planning issues we have, where appropriate, collapsed issues which appear to have conceptual unity when viewed from the communication planning perspective.

RATIONALITY

It seems clear that the bulk of educational planning has been rationalistic, based on "codified knowledge, and comprehensive sequential analysis," although other, less rationalistic forms of planning are developing. Communication planning seems to be developing in the opposite direction, from disjointed, incremental planning at a number of levels in a variety of institutions. Communication planners, who will be dealing under almost any social/political structure with a much less formally organized (and thus less controllable) system, may well find the attainment of formal, rationalistic planning impossible, undesirable, or both--particularly at the national level. Planning within single institutions, or sets of highly coordinated institutions, where the boundaries and clients of the system may be relatively well defined, may approach the "rationality" of educational planning, although the appropriateness of existing planning models may still be questioned.

SOCIAL DEMAND AND EQUITY

Although treated separately in our review of educational planning, these issues are closely linked. Social demand approaches to educational planning are based on the widely--though not completely--shared idea that everyone ought to get as much schooling as possible. Equity issues arise out of the debate on whether everyone has a right to the same opportunities, or whether they have a right to equitable outcomes. The right to equal opportunity has historical, political and legal foundations. The right to equal outcomes is a more recent concept, founded in sociological research, buttressed by ideology, but without an equally firm foundation.

A parallel issue is emerging in communication known as the "right to communicate." As most recently expressed by Unesco (1976), this issue reflects expanded concepts of the right to freedom of expression and opinion consonant with the increased communication resources available through mass media. Freedom of expression expands to become the freedom to inform and be informed. Practical implications of the issue include rights of access to mass media; balancing rights of individuals, nation states, and media institutions and professionals; and the idea of "balanced" as distinguished from "free" flow of information and news between nations (see Richstad 1977, for a review of these issues).

It seems possible, at least, that communication planners are currently struggling with how to provide, in the educator's terms, "equal opportunity." Whether they will in time to confront the issue of "right to equal outcomes" merits reflection. The assessment problems facing educators who are serious about demonstrating equal outcomes are severe enough. They will be much more difficult in the disorganized set of institutions and agencies which make up the national system of communication.* It is likely, though, that the success of educa-

* Although the issue is more tractable for individual communication activities, and has recently surfaced in the debate over equality of outcome for Sesame Street (Cook, et al., 1975).

tion in achieving equality of outcomes will certainly affect the extent to which communication planners can hope to guide their system in a similar direction. While we may grant all the right to communicate, the relative quality of education in society is directly related to the ability to communicate (see chapter one).

MANPOWER PLANNING

Manpower planning as an issue rather than as a planning model (see below), alerts communication planners to several facets of their task. The first is obvious: where the educational system is guided by manpower planning models, communication planners would do well to help set skilled manpower targets for the communication system. Porat's sectoral analysis (1976) would push communication planners towards responsibility for an exceptionally broad segment of the labor force should planning indeed become national, comprehensive and rational. As noted above, this seems unlikely in the near future; and, moreover, Porat's manpower scheme, while sound for purposes of certain kinds of economic analysis, is too broad for immediate communication planning needs. However, manpower plans for key communication industries and institutions could, and should, be part of comprehensive communication planning, provided the contextual difficulties of applying manpower models are carefully noted. Outputs of the educational system are important inputs for communication.

The second issue reverses this input/output relationship. We have noted that various labor market processes and other mechanisms can either mediate or substitute for manpower planning. Communication functions within these factors, particularly in such areas as provision of employment information and in mediated distance learning vocational courses. Rapidly nearing is widespread substitution of communication for physical movement, and this will alter patterns of work and employment. As communication policy development and planning activity becomes more firmly established, this functional area should be a major focus of analysis. Coordination with the educational planning on this issue would seem important.

COST-EFFECTIVENESS ANALYSIS

There seems to be little question that cost-effectiveness analysis, if not cost-benefit, is a generally useful planning tool and that it has applications in communication planning. The nature of the national communication system seems to indicate that the "mission" approach, in which various cost-effectiveness analyses are applied at sub-national levels as tools for evaluation of alternative strategies have the most promise (more of this in the discussion of models below).

INTEGRATED PLANNING

Integration of currently diffuse planning efforts is perhaps the first item on the national communication planner's agenda. Integration will have to be both vertical through levels, and horizontal among agencies with planning and policy making functions in the communication sector. It will also have to deal with both public and private sector communication activity.

Policy formulation will be important, often in the form of regulation, perhaps equally often in the formation of coordinating agencies (such as has taken place for coordination of family planning communication activities in a number of countries). This coordination task has been less salient in planning education in developing countries, where relatively unified national systems of education are the rule, as well as in some developed countries with strong traditions of local and independent education, for opposite reasons. In the first case, it has been perceived to be unnecessary (often at great cost in eventual implementation of plans). In the second, there has been strong resistance to the idea of integration. In both cases this is changing; and in both developed and developing countries the need for integration and coordination of diverse communication activity is recognized. This will lead communication (and education) planners to strategies of inter- and intra-organizational coordination based on organizational theory (see Beal and Middleton 1975, for an applied example).

LOCALIZATION OF PLANNING

With this issue education and communication planners meet on common ground. Integration and coordination must be balanced with local planning. In particular, the development of effective communication messages and software (and educational materials and programs) requires understanding of local audiences, and flexibility to deal with differing communication styles and media access. Here communication planners will have to distinguish between planning of communication systems (telecommunications, mass media) and development of messages and software. The former may be done centrally; the latter must often be done locally.

LIFELONG EDUCATION

Again this is an issue of mutual interest to education and communication planners. Often approaching from different institutional bases, occasionally from integrated institutions (such as the Open University), both see needs for continuing learning as a major rationale for action. Educational planners tend to carry their focus on employment and vocational learning over into this area; communication planners are likely to deal with broader social issues. Planning approaches, again, should be complementary and coordinated.

WORK, WORLD VIEWS, AND THE DEVELOPMENT CONTEXT

As we have noted, employment opportunity is widely seen as a major motive for acquiring education. We have also noted the existence of different schools of thought on labor markets and manpower planning. The existence of these differing world views bring the education planner to grips with ideology as a major driving force in planning.

As reflected in Hancock's definition of communication planning (see p. 2, Chap. 1), communication planners are beginning the development of their craft with explicit recognition of this reality. Here the schools of thought rise not from differing theories of employment but, reflecting the interrelation of communication with all aspects of society, from different socio-political ideologies. One obvious example is the need for communication planners to work within the tensions between various "rights" to opinion, expression and communication on the one hand, and desires to utilize communication systems to bring about behavior conducive to national development. This issue brings with it the question of the communication planner's self-image. Are they to be technicians, working at the effective implementation of given policies, or are they to enter the policy/ideology debate? Educational planners have confronted this issue, and have tended, in practice, to come down on the technician side. Whether this will be the outcome for communication planners is a major and continuing issue.

NONFORMAL EDUCATION

This issue is clearly of concern to planners both in education and communication, forming a major intersection of problem focus. Educational planners plan the use of communication media; communication planners plan extension classes with teachers and students.

Our review has noted the emphasis on the functional nature of non-formal education. This emphasis is consistent with most communication planning viewpoints, although educational planners may tend to carry their emphasis on employment over into an emphasis on skill development in nonformal education. Communication planners, on the other hand, are likely to view nonformal education more broadly, incorporating such functions as value and behavior change, particularly in the process of mobilization of mass audiences for participation in social and economic development. This is not a clear-cut distinction, of course, as educational planners are also concerned with such functions. However, the difference in emphasis may lead communication planners to confront more directly issues considered "beyond the scope" of conventional educational planning: ideology and structural change through mobilization. If nothing else, the extensive use of mass media for political communication forces the issue into the forefront of concerns of communication planners. Again, the related issue of communication planner as technician or participant in the policy formulation process (particularly for message content and design) arises.

MODELS AND INDICATORS

In the preceding section we have examined the issues of educational planning from the perspective of communication planning. Here we modify the conceptual structure by examining the models and indicators of educational from the perspective of four major functional areas of communication planning: mass media and public information, telecommunication systems as socioeconomic infrastructure, communication for development, and communication for education. We begin the examination with a discussion of the underlying nature of planning models.

PARTIAL CONVERGENCE ON HEURISTIC MODELS

In our review of educational planning models we noted the differences between two broad classes of models: algorithms representing processes in mathematical terms constructed in such a way as to yield clear "solutions"; and heuristics, which depict logical relationships that help in the exploration of possible solutions (see p. 228). Educational planning has relied heavily on the former, with the major emerging exception of instructional design models. Communication planning, on the other hand, seems to be beginning with heuristics in many areas (exceptions are the engineering models used to design telecommunication hardware systems).

Algorithms would seem to work only with relatively fixed systems with closed boundaries. This has been the case with much educational planning. The comparatively open "systems" of communication in society as yet seem inappropriate for algorithms. It is not insignificant that the major borrowing of educational planning models in communication planning has been in instructional design, and for a major point of intersection of function between the two disciplines.

The current reliance on heuristics in communication planning may be traced to several additional sources. One is the nature of communication theory building which, with the exception of Shannon and Weaver's work on

mathematical models (1949), has been largely heuristic, with the resultant models being useful primarily as paradigms for research. These paradigms change relatively often (Schramm and Roberts 1971; Harms, in Rahim and Middleton 1977), reflecting the early stage of the development of communication theory.

A second source is the nature of major tasks facing communication planners: defining the national system of communication, marking its boundaries and depicting the many complex relationships among the components, and developing long-range goals. Here heuristics such as Delphi (Wedemeyer 1976) and heuristic forms of systems analysis are being found useful.

It is possible that, as understanding of national communication systems increases, planners may wish to move towards algorithms, presumably in the first stages for single system components.

At the same time, educational planners are turning toward broader social issues and functions, opening the boundaries of their system, and exploring indicators and linkages other than manpower and employment generation. In this they may well move, at least initially, with heuristic models. Thus the possibility for at least partial convergence toward common planning models exists.

MASS MEDIA AND PUBLIC INFORMATION

Here two traditional models of educational planning--manpower planning and production functions--appear to offer little immediate help. Primarily useful in closed systems, these models also depend on the ability to define outputs in reasonably precise terms, such as manpower targets, aggregate quantifiable outputs (such as numbers of students graduated) or economic values (discounted future earnings of graduates at different levels of education). In open communication systems, such models seem not to apply. The indicators that are used with mass/media public information functions are rather less precise, and difficult to express in economic terms. Audience size, for example, may be analogous to student enrollment or graduation indicators, but is difficult to determine in disaggregated fashion (i.e., by age group). Given the diverse purposes, content and structures of general mass media programming, it is even more difficult to isolate effects in such a way as to calculate economic benefits directly.

Cost-effectiveness models seem more useful, particularly in assessing effects of media campaigns with focussed objectives and well-defined target audiences. It is possible, and no doubt desirable, to measure audience changes in information level, attitude shifts and behavior change. Using experimental and quasi-experimental methods, it is also possible to associate such indicators with specific campaigns with definable costs. In some instances, where the desired behavior change can be shown to have economic value, such as adoption of contraception, true cost-benefit analysis can be developed (Robinson 1971).

TELECOMMUNICATION SYSTEMS AS SOCIO-ECONOMIC INFRASTRUCTURE

Melody has pointed out the difficulty of measuring long-term benefits of the development of telecommunications infrastructures (Rahim and Middleton 1977). This is particularly troublesome given the capital-intensive nature of telecommunications development.

Again, manpower and production function models appear difficult to use. Heuristics can outline labor market functions of telecommunication systems. It may be possible to develop logical arguments that the absence of telecommunication can form barriers to economic and social development: i.e., the coordination of widespread development action programs is difficult, if not impossible, in the absence of telephone (or radio) and postal systems. Demonstrating the contribution of these systems in economic terms is much more difficult, though the idea of production functions is valuable. The trick will be to develop them. If communication planners can succeed in this task, they will be in better position to integrate communication planning with national economic planning, able to compete with other sectors for investments on economic grounds.

Cost-benefit and cost-effectiveness models, with their inherent emphasis on comparison of alternative investments, pose a particularly interesting problem for telecommunications planners. The high costs of large scale telecommunication systems, the time required to develop them and put them into operation, and their permanence once constructed make decision-oriented use of cost-effectiveness or cost-benefit analysis in one country (or region) difficult, even if indicators of effect or benefit can be constructed, and data gathered. Potential for cross-national comparison for decision making offers the best hope, though indicator problems remain.

COMMUNICATION FOR DEVELOPMENT

We have noted the applicability of cost-effectiveness analysis to mass media campaigns above. Campaigns in support of development programs, of course, offer the same planning situation, and the models apply. Similarly, extension and nonformal education programs in support of development projects can be measured, if not planned, using cost models.

There is, however, an aspect of campaign (and nonformal education) planning for which cost models

offer little help. This is the development of strategies which incorporate media and message factors with understanding of audiences to achieve optimal effects, whether in information, attitude or behavior change. The analogous task in educational planning is the design of classroom learning activity, illustrating the micro-level of the concern.

Strategy development of this kind requires the communication planner to apply communication theory to reality, always with political, cultural and institutional constraints and resources in mind. In this planning task, instructional design models borrowed from education have great potential. Of particular value is their emphasis on explicit, learning theory-based strategy; clear and measurable outcomes; and emphasis on formative evaluation. Here, unlike telecommunications planning, data can be used to modify and improve programs and to compare alternatives. Cost-effectiveness and, perhaps, cost-benefit models can be usefully wedded with these heuristic, creative models to form a valuable hybrid for communication planning of this type.

COMMUNICATION FOR EDUCATION

As one would expect, this functional area of communication has most to gain from educational planning, in both nonformal and formal modes. Of chief importance are instructional design models, which can guide the communication planner in the development, evaluation and improvement of mediated learning programs of all kinds.

We have noted that nonformal education is an important point of overlap of interest for education and communication planners. To the extent that the goals of a nonformal education program are amenable to the development of economic indicators, they may be treated with formal manpower or production function models. To the extent that such programs involve communication media, or are planned by individuals with communication backgrounds, they may be considered the results of communication planning. Here communication planners may borrow freely from educational planning, though they should do so understanding the reasons why educational planners are themselves questioning these algorithms.

For example, one could make a cost-benefit analysis, using rate of return methods, for a broadcast job information program, if one could clearly identify the intended audience, and somehow trace individuals affected by the broadcast as they responded to job opportunities. The *a priori* difficulty would not be with the model *per se*, but with the open nature of the communication system, the comparative difficulty of specifying and controlling audiences, and thus with the development of data.

The fugitive audience constraint is reduced when communication planners work within formal education systems. Given the cost of investment in communication technology, rate of return models may be appropriate, and have in fact been used to assess major educational television projects (Carnoy 1975). The problem here, as in education, is the development of indicators which reflect the diverse outcomes of education as well as some of the media-specific outcomes not known (or noticed) to be part of more traditional educational processes. An example of this latter is the finding in the El Salvador ETV project that general ability gains for students taught with television significantly exceeded those for traditionally-taught students; and that this difference was largely explained in terms of gains in non-verbal skills (Schramm 1977).

STRATEGIES

Review of educational planning strategies identified three broad categories of concern: the development of institutional planning capacity, social processes that affect planning, and strategies for the growth and development of planning systems. Implications of each for communication planners are discussed below, together with an added dimension of concern to communication planners not salient in the literature of educational planning.

INSTITUTIONAL PLANNING CAPACITY

The idea of linked capacities within a planning system is useful for communication planners, who face the task of building this capacity in almost every nation. Added to issues of plans, statistical service and implementation mechanisms for communication planning is the question of where such a unit would be located. There is no obvious institutional home, despite the existence of information ministries and departments. Economic planning boards or prime ministers' offices may be the answer, though a number of models will inevitably be tried--assuming the creation of a centralized planning unit is possible, or desirable.

SOCIAL PROCESSES

The fundamental nature of communication and communication systems in society has brought these issues into the planning process even as it has developed. It is difficult to conceive of any of the processes

reviewed being "outside the scope" of communication planning for any organic or naturally occurring institutional reason. They will lie outside the communication planning domain only if planners place them there, and the experience of educational planning indicates that they would, in any case, eventually work their way back in--perhaps at some cost.

STRATEGIES FOR THE GROWTH AND DEVELOPMENT OF PLANNING SYSTEMS

The ideas developing in educational planning on ways to develop planning systems that can learn from experience, grow and improve are among the most important lessons for communication planners. That the relatively well-established discipline of educational planning has come to find such strategies necessary after some two decades of existence is significant. Communication planners would do well, as their craft develops and spreads, to incorporate such strategies from the beginning. Perhaps the self-learning process can be accelerated.

Of the three strategies described, knowledge networking seems most applicable. The emphasis on development of a "repertoire of successful strategies" through the accumulation of case studies is practicable and, in fact, has been begun.* A reasonably well-coordinated effort by those developing communication planning in diverse institutions to share case analyses, as well as more fundamental research and model building, could be extremely fruitful. The group of "communication planners" and interested academicians is small, and relatively well known. A new international journal (*Telecommunications Policy*) has appeared, and a number of international conferences with overlapping membership have been held. Unesco is moving to develop a documentation service.

In short, the elements for a network are in place. What remains is the will and resources to operate it, and the recognition by planners and scholars of the value of rapid sharing of experience.

Creative learning may develop out of such a network, but is not likely to develop without it.

AN ADDITIONAL DIMENSION: HUMAN INTERACTION

One of the problems inherent in building macro-level systems concepts and models is a tendency to overlook the fact that not only do people build the models, they are also found inside the equations or flowcharts (algorithm or heuristic) trying to make the models work.

The processes through which individuals and groups interact to plan and make decisions is the subject of much study in organizational science, with several theories available for use. Understanding of these processes is particularly important for communication planning, which faces the challenges of building planning teams as well as institutions. Newly assembled teams of individuals with diverse responsibilities, skills and ideologies (not to speak of cultures) will have to deal with a great many unknowns. Strategies for the development and management of such teams will emerge from experience if explicit attention is paid to the problems and processes as part of the planning, and shared through knowledge networks (see Hancock, in Rahim and Middleton 1977, for an example of this kind of scrutiny).

CONCLUSIONS

There are lessons in the experience of educational planners for their communication counterparts. Current issues in educational planning alert communication planners to some of the stones in their path, such as the problems of equal opportunity or equality of outcome, and of the impact of ideology on planning. There are overlapping areas of focus, such as non-formal education and the use of communication technology in formal school settings, where the disciplines merge and use common models. The move in educational planning beyond system boundaries to encompass broader social issues, and the resultant increase in task complexity, highlights the difficult issues facing communication planners beginning without boundaries. The firm foundation of education as a social good, one that ought to be universally available, has enabled educational planning to turn to economic indicators and linkages. A similar philosophical base has to develop in communication planning. Thus communication planners must continue to struggle with the issue of whether communication is a right, to be planned and controlled (like other rights) through regulation; or a resource to be allocated through objective, non-normative models and criteria. That advocates of the "right to communicate" and "fair communication

* At least ten studies to map out the domain of communication planning in Asia and the United States are beginning in 1977-78 through the East-West Communication Institute. Unesco has been careful to document early efforts at national communication planning, is developing and testing a theoretical framework (Hancock 1977), and is initiating a case study series.

policy" speak of communication as a resource highlights the difficulty of this conceptual problem.

Communication planners may borrow certain models from education, notably cost-effectiveness and cost-benefits approaches, and instructional design. There may be a convergence toward common use of heuristic models, which typifies communication planning at this time. This may be an area in which educational planners may take lessons from communication planning as it develops.

Other models, formal and algorithmic, do not transfer well, though there may be a need in telecommunications planning to develop algorithms which include production functions relating systems to socially and economically valuable outputs. This is an area for creative work and not borrowing; except insofar as the concepts and techniques of production functions apply.

A very valuable lesson can be learned from the emerging recognition of the need to develop planning systems that learn, grow and develop through shared experience.

Finally, the existence of areas of functional overlap, the common move toward heuristic models dealing with complex social realities outside of system boundaries, the need to plan manpower development for communication, the effects of education in preparing individuals for participation in broader communication systems, and the concept of the formal school system as a major communication medium in society all augur for increased integration of planning efforts in the two "sectors." Whether such integration is possible, together with its implications (an integrated "social-learning system") is an important question for all.

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